

Program
Management

COMPREHENSIVE COASTAL INVENTORY PROGRAM

FINAL REPORT

VOLUME II

Coastal Inventory Program
Commonwealth of Virginia

and

Tidal Rivers Inventory Project
Coastal Resource Management Program
Grant No. NA89AA-D-CZ134
Task 2A
Grant No. NA88AA-D-CZ091

COASTAL ZONE
INFORMATION CENTER

Compiled by
Marcia R. Berman
J. Berchman Smithson

Under the Direction of

Dr. Suzette M. Kimball
Dr. Carl H. Hershner, Jr.

Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, Virginia 23062

Submitted To

Virginia Council on the Environment
Richmond, Virginia

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U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER **Compiled by**
2234 SOUTH HOBSON AVENUE **Marcia R. Berman**
CHARLESTON, SC 29405-2413 **J. Berchman Smithson**

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VOLUME II.

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CHAPTER VIII. 1989 SHORELINE COVERAGE

VIII. 1989 SHORELINE COVERAGE

The 1989 vertical photographs collected by VIMS (ref. Chapter 6) were used to establish the 1989 shoreline position. Registration of the photographs against known benchmarks was necessary before mapping could begin. The VMRC shoreline maps (ref. Chapter 3) are registered through an extensive set of surveyed benchmarks, each identified by a state plane coordinate pair. These benchmarks are shown on the map. However, this set of maps does not contain surveyed locations of physical parameters, such as a house or road intersection, that can be identified on photographs. The photographs do not show benchmark markers. Consequently, the photographs could not be mapped directly onto the VMRC shoreline base.

The benchmarks used by the VMRC were relocated in the field with the assistance of VMRC staff. They were used to establish base reference points for all subsequent field work, which included surveying the locations of physical features that could be identified in the photographs. With both the aerial imagery and the shoreline maps keyed to the state plane coordinate system, overlays of the two shoreline positions could be made.

Field efforts were concentrated along a portion of the Potomac River and the eastern shore of Lower Machodoc Creek in Westmoreland County. A Topcon GTS-3B infrared digital survey instrument was used for field surveys. State plane coordinate pairs for each surveyed feature were subsequently entered into the ARCInfo^e format and stored as a GIS coverage.

The field surveying, although extremely accurate (error <.02% over a 12-mile reach), was labor-intensive and prohibitively expensive. It was determined that field surveying of the 5,000 miles of coastline to be included eventually in the database was not feasible given the time and cost constraints dictated by the program scope of work. Consequently, other methods of annotating photographic benchmarks were investigated. The method showing the greatest potential in terms of accuracy (positioning to within 1.5 m), time and cost is a Global Positioning System (GPS). Acquisition of such a system is planned for 1990-1991 and all subsequent surveying activity will be with GPS technology.

Once photographic benchmarks were established, a Bausch & Lomb ZT4-H Zoom Transfer Scope (ZTS) was used to superimpose the 1989 shoreline image onto the 1976 baseline for transcription. State plane coordinate values of the photographic control points previously entered into the database were merged with the VMRC shoreline data coverage and plotted at 1:7,200. Because the images are scaled at 1:7,200, this becomes the highest usable resolution, despite the 1:5,000 scale of the VMRC maps.

The ZTS uses a system of mirrors and lenses to transfer one image onto another. With a minimum of two control points in each field of view (three points are preferable, and more were used in complex areas), the photographic control points on the prints are adjusted and aligned with the plotted points on the baseline maps. During this process, image distortion due to linear stretch and rotation can be diminished or removed. The position of the shoreline is transcribed by a staff member who distinguishes tonal changes on the image that are due to variations in the water content of the foreshore sediments. The transcribed map line width is 0.3 mm which is equivalent to 1.5 m ground distance at a scale of 1:7,200. Thus, the functional precision of the transcribed shoreline position is +/- 1.5 m.

Once transcribed, the shoreline position is digitized in the same manner as the 1976 baseline and stored as a data layer. The VMRC shoreline maps are referenced to mean low water. As it exists, the 1989 shoreline position is not tide-corrected. However, each photograph is documented in terms of the flight date and time in order to complete tide-stage corrections. Work is continuing on the development of algorithms to automatically correct the shoreline position.

COASTAL INVENTORY
AVERAGE TIME AND DISC SPACE USED*
1989 VIMS SHORELINE

MAP NUMBER	TIME	DISC SPACE
6152560	.75	135168
6302560	.5	137216
6452540	2.5	30720
6602520	2.75	147456
6602540	.75	30720
<hr/>		
AVERAGE	1.45	96256

*TIME IN HOURS, DISC SPACE IN BYTES

VIMS SHORELINE COMPARISON STUDY

Westmoreland County

✓ 1976 VMRC Shoreline

✓ 1989 VIMS Shoreline

POTOMAC RIVER

Lower Machadoc Creek

meters

0

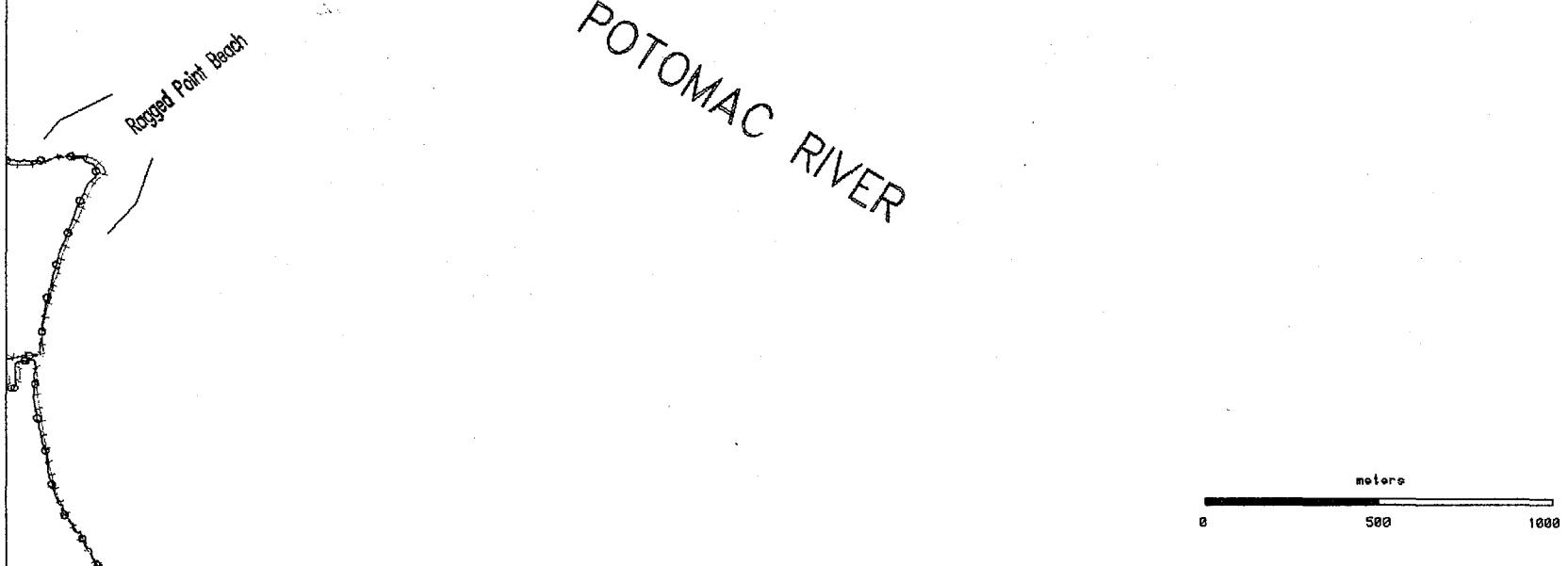
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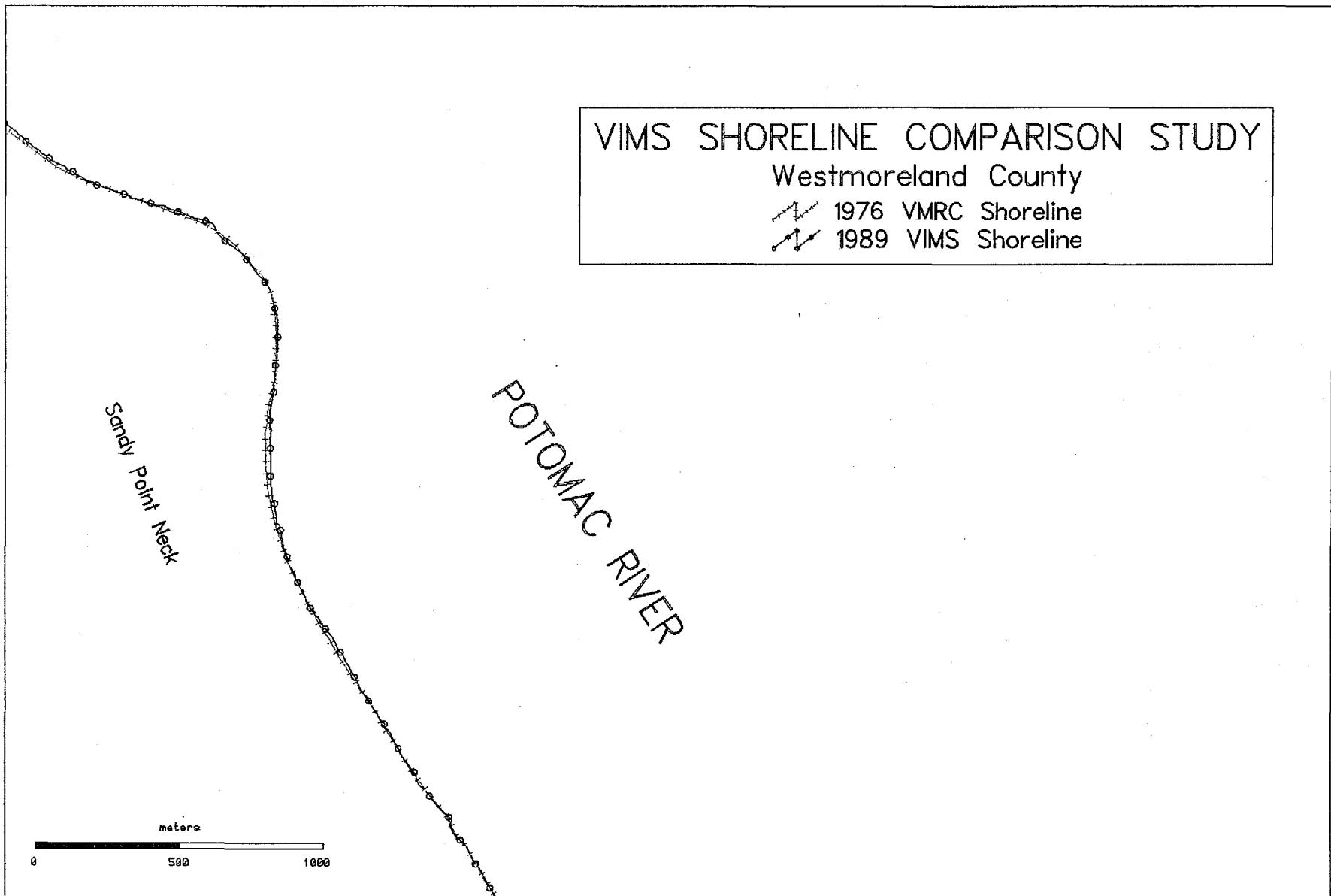
1000

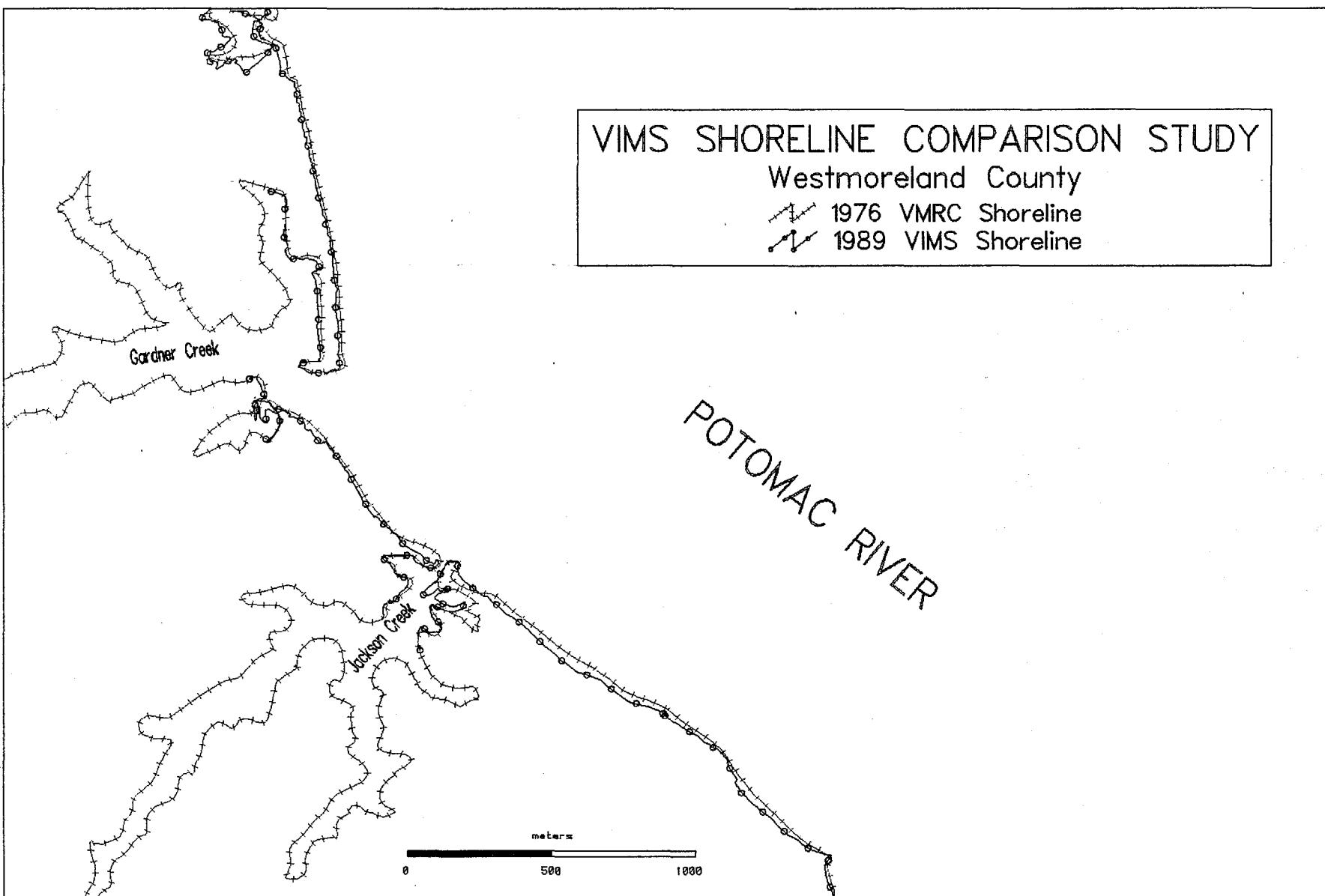
Scale bar: 0 to 1000 meters

Scale bar: 0 to 1000 meters

VIMS SHORELINE COMPARISON STUDY
Westmoreland County
✓ 1976 VMRC Shoreline
✓ 1989 VIMS Shoreline







CHAPTER IX. SHORELINE STABILIZATION COVERAGE

IX. SHORE STABILIZATION STRUCTURES

The Shore Stabilization Coverage (STRUC) is the longshore delineation of man-made mitigation structures along the coast. A portion of Westmoreland County has been completed and the folio is presented here at a scale of 1:20,000. The coverage is limited to riprap, bulkheads, groin fields and jettys which can be easily identified from the vertical images.

Delineations were performed using geographically registered vertical photographs (ref. Chapter 3) and scaled plots of the MRC shoreline record. A Zoom Transfer Scope was used to transpose the vertical image onto the computer generated plots of the 1976 shoreline position at a scale of 1:7200 (photo scale). The digital coverage is created by digitizing and coding the linear extent of the shoreline defended by each of the considered mitigation structures. Combinations of engineering structures were also coded separately. The total length of a shoreline reach artificially protected can then be computed. This information is important for assessing the effectiveness of mitigation structures in halting shore erosion, as well as quantifying the volume of sediment lost to the littoral system as a result of the defense. The following documentation contains information pertaining to the STRUC coverage.

GEOGRAPHIC DATA SET DESCRIPTION

VIMS GIS Lab Prefix STRUCT

Data Layer Name SHORE STABILIZATION COVERAGE

Description A COVERAGE OF SHORELINE STRUCTURES INCLUDING RIP RAP,
BULKHEADS, GROINS AND JETTYS.

Year(s) Collected 1989

Base Maps used for Digitizing VMRC SHORELINE MAPS

Digitizing Scale 1:7200

Geographic Extent PORTION OF WESTMORELAND COUNTY

How Collected (Describe):

THE 1989 VERTICAL PHOTOGRAPHS WERE SUPERIMPOSED ON TO THE VMRC SHORELINE
MAPS USING A ZOOM TRANSFER SCOPE (ZTS). THE POSITION OF STRUCTURES WERE
DELINEATED AND THEN DIGITIZED.

Actual/Intended Use or Purpose:

TO QUANTITATIVELY ASSES THE AMOUNT OF SHORELINE DEFENDED BY ARTIFICIAL
STABILIZATION METHODS.

COASTAL INVENTORY

AVERAGE TIME AND DISC SPACE USED*

1989 SHORELINE STRUCTURES

MAP NUMBER	TIME	DISC SPACE
6152560	1.25	135168
6302560	.75	141312
6452540	2.5	278528
6602520	2.75	397312
6602540	1.0	145408

AVERAGE | 1.65 | 219545

*TIME IN HOURS, DISC SPACE IN BYTES

VIMS SHORELINE STRUCTURE STUDY
Westmoreland County

MAP NO. 6452540



Gardner Creek

Jackson Creek

POTOMAC RIVER

.....	RIPRAP
++	BULKHEAD
xxxx	JETTY
—	GROIN
—	GROIN/BULKHEAD
- -	GROIN/BULKHEAD/RIPRAP
---	GROIN/RIPRAP
—	BREAKWATER SHOREFACE DISCONNECTED
o —	BULKHEAD/RIPRAP
—	NO STRUCTURES NOTED



TABLE 1. SHORELINE STABILIZATION STRUCTURES
WESTMORELAND COUNTY - L6452540

Structure	Code	Total Length (m)	Frequency*
Riprap	1	339.03	5
Bulkhead	2	59.63	1
jetty	3	-----	0
groin field	4	351.90	3
breakwater (off)	8	67.20	1
groin/bulk.	9	1212.37	5
groin/rip.	10	130.95	3
gr/bulk/rip.	11	-----	0
bulk/rip.	13	1009.60	1
no structures	22	5975.46	10

* Frequency = number of arcs

Total number of arcs = 29

Total shoreline length = 9,146.14 meters

TABLE 2. SHORELINE STABILIZATION STRUCTURES
WESTMORELAND COUNTY - R6452540

Structure	Code	Total Length (m)	Frequency*
Riprap	1	267.24	5
Bulkhead	2	-----	0
jetty	3	221.24	2
groin field	4	25.82	1
breakwater (off)	8	-----	0
groin/bulk.	9	75.31	1
groin/rip.	10	-----	0
gr/bulk/rip.	11	-----	0
bulk/rip.	13	-----	0
no structures	22	2392.07	8

* Frequency = number of arcs

Total number of arcs = 17

Total shoreline length = 2,981.68 meters

VIMS SHORELINE STRUCTURE STUDY
Westmoreland County

MAP NO. 6302560

Sandy Point Neck

0 500 1000 meters

POTOMAC RIVER

....	RIPRAP
++	BULKHEAD
xxxx	JETTY
	GROIN
- -	GROIN/BULKHEAD
---	GROIN/BULKHEAD/RIPRAP
---	GROIN/RIPRAP
—	BREAKWATER SHOREFACE DISCONNECTED
o o	BULKHEAD/RIPRAP
—	NO STRUCTURES NOTED

TABLE 3. SHORELINE STABILIZATION STRUCTURES
WESTMORELAND COUNTY - L6302560

Structure	Code	Total Length (m)	Frequency*
Riprap	1	1117.56	5
Bulkhead	2	-----	0
jetty	3	-----	0
groin field	4	353.69	4
breakwater (off)	8	-----	0
groin/bulk.	9	2040.62	7
groin/rip.	10	181.65	2
gr/bulk/rip.	11	-----	0
bulk/rip.	13	-----	0
no structures	22	1647.29	4

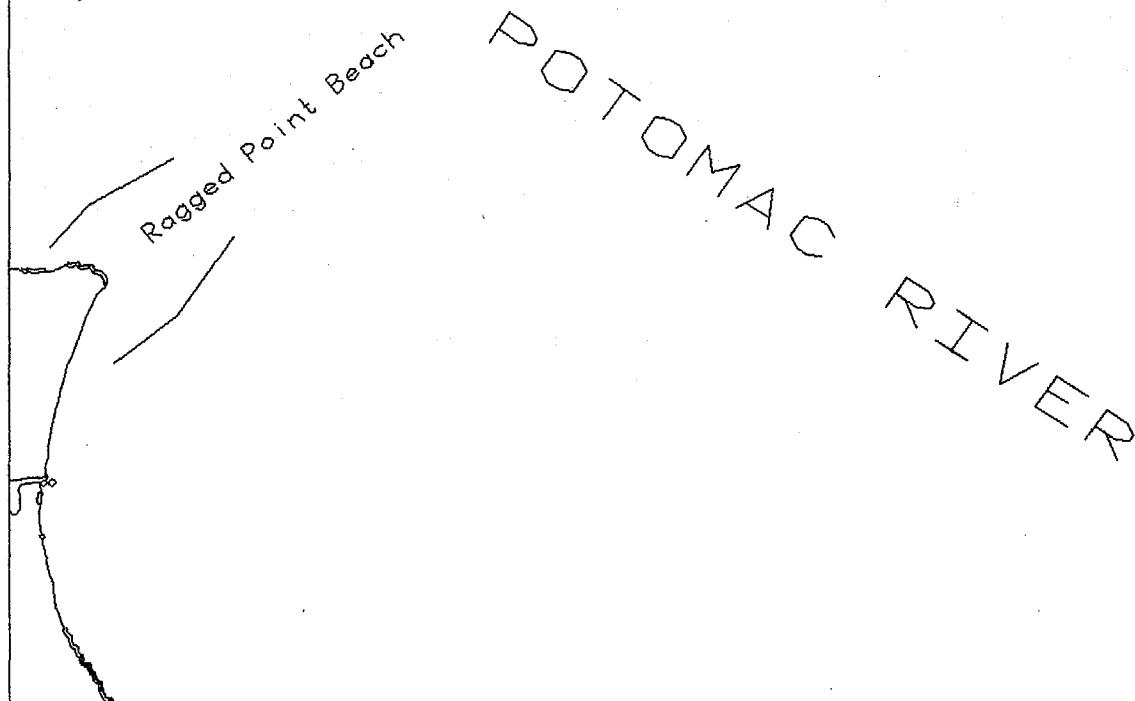
* Frequency = number of arcs

Total number of arcs = 22

Total shoreline length = 5,340.81 meters

VIMS SHORELINE STRUCTURE STUDY
Westmoreland County

MAP NO. 6602540



....	RIPRAP
++	BULKHEAD
xxxx	JETTY
—	GROIN
—	GROIN/BULKHEAD
- -	GROIN/BULKHEAD/RIPRAP
---	GROIN/RIPRAP
—	BREAKWATER SHOREFACE DISCONNECTED
○—○	BULKHEAD/RIPRAP
—	NO STRUCTURES NOTED

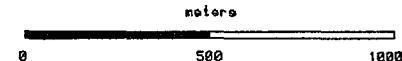


TABLE 4. SHORELINE STABILIZATION STRUCTURES
WESTMORELAND COUNTY - L6602540

Structure	Code	Total Length (m)	Frequency*
Riprap	1	13.3	1
Bulkhead	2	638.31	7
jetty	3	60.53	3
groin field	4	858.21	11
breakwater (off)	8	-----	0
groin/bulk.	9	620.71	7
groin/rip.	10	-----	0
gr/bulk/rip.	11	-----	0
bulk/rip.	13	-----	0
no structures	22	2063.61	13

* Frequency = number of arcs

Total number of arcs = 42

Total shoreline length = 4,254.67 meters

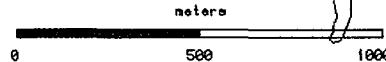
VIMS SHORELINE STRUCTURE STUDY

Westmoreland County

MAP NO. 6602520

POTOMAC RIVER

Lower Machodoc Creek



....	RIPRAP
+++	BULKHEAD
xxxx	JETTY
—	GROIN
—	GROIN/BULKHEAD
- - -	GROIN/BULKHEAD/RIPRAP
---	GROIN/RIPRAP
====	BREAKWATER SHOREFACE DISCONNECTED
—o—	BULKHEAD/RIPRAP
—	NO STRUCTURES NOTED

TABLE 5. SHORELINE STABILIZATION STRUCTURES
WESTMORELAND COUNTY - L6602520

Structure	Code	Total Length (m)	Frequency*
Riprap	1	986.85	8
Bulkhead	2	-----	0
jetty	3	88.97	2
groin field	4	179.05	2
breakwater (off)	8	-----	0
groin/bulk.	9	-----	0
groin/rip.	10	121.00	1
gr/bulk/rip.	11	-----	0
bulk/rip.	13	-----	0
no structures	22	13,902.72	20

* Frequency = number of arcs

Total number of arcs = 33

Total shoreline length = 15,278.59 meters

TABLE 6. SHORELINE STABILIZATION STRUCTURES
WESTMORELAND COUNTY - R6602520

Structure	Code	Total Length (m)	Frequency*
Riprap	1	952.09	12
Bulkhead	2	564.52	5
jetty	3	-----	0
groin field	4	419.58	6
breakwater (off)	8	-----	0
groin/bulk.	9	1688.75	10
groin/rip.	10	81.27	2
gr/bulk/rip.	11	23.81	1
bulk/rip.	13	-----	0
no structures	22	3395.97	19

* Frequency = number of arcs

Total number of arcs = 49

Total shoreline length = 7125.99 meters

CHAPTER X. SEDIMENT SAMPLE COVERAGE

X. SEDIMENT SAMPLE COVERAGE

A sediment/slope data coverage (SED) has been incorporated into the GIS network at VIMS. Sediment size data and shoreface slope measurements are necessary to forecast potential storm surge incursion and erosion rates as well as to provide a data base from which to manage the Commonwealth's sand allocation procedures through the Shoreline Programs Bureau of the Department of Conservation and Recreation. Sediment samples and beach slope measurements have been collected from the backshore and foreshore beach units at 500 meter intervals along the tidal shorelines , or wherever there is a significant change in sediment size or beach slope. Beach slope was measured only at the foreshore with a Brunton Compass.

Sample locations were plotted and digitized at a scale of 1:24,000 and entered into the GIS framework. Sediment samples were processed at the VIMS Sediment Laboratory, and grain size distributions have been calculated using a combination of Rapid Sediment Analyzer (RSA) and pipette techniques. The RSA method measures the fall velocity of a grain and translates the fall velocity into an equivalent grain diameter. Pipette analysis similarly measures grain diameter as a function of density and settling time. These techniques are preferable to mechanical sieving methods when the hydraulic transport characteristics (e.g., erosion and deposition) of the sediment are of paramount importance. All sediment samples are archived at VIMS.

Grain size percents, standard sediment distribution statistics, and moment statistics were calculated and entered into the GIS data base as an attribute by station. Slope measurements are similarly stored as an attribute table within the SED coverage. The information can be queried through the system by choosing a site on the sediment station coverage. Foreshore and backshore data are stored as separate attributes.

Following is a folio of all anticipated sediment station for the Northern Neck region of Virginia. Maps are represented at a scale of 1:68,000. The current available sediment and slope attribute data for the Northern Neck is included in tables divided by county. The database will be updated as more sediment samples are processed.

GEOGRAPHIC DATA SET DESCRIPTION

VIMS GIS Lab Prefix SED

Data Layer Name SEDIMENT SAMPLE COVERAGE

Description COVERAGE INCLUDES A PLOT OF SAMPLE SITE LOCATIONS,
SEDIMENT SAMPLE ANALYSIS AND BEACH SLOPE MEASUREMENTS.

Year(s) Collected 1989-1990

Base Maps used for Digitizing USGS TOPOGRAPHIC MAPS (MYLAR MEDIUM)

Digitizing Scale 1:24,000

Geographic Extent NORTHERN NECK OF VIRGINIA

How Collected (Describe):

SEDIMENT SAMPLES WERE COLLECTED BY HAND FROM THE FORSHORE AND BACKSHORE
AT DESIGNATED SITES. FORSHORE SLOPE MEASUREMENTS WERE MADE WITH A
BRUNTON COMPASS. STATIONS WERE PLOTTED ON TOPO SHEETS AND DIGITIZED.

Actual/Intended Use or Purpose:

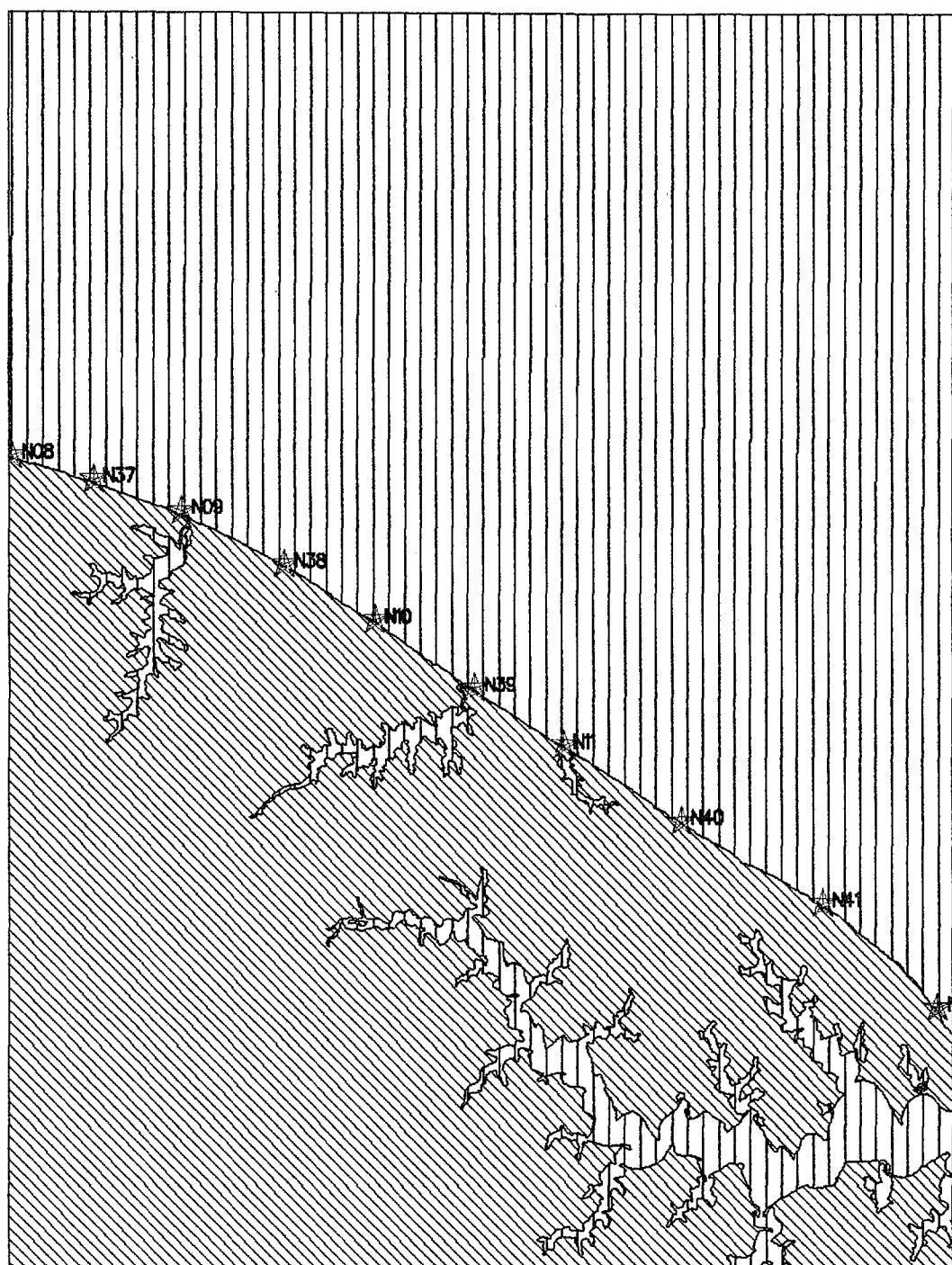
MAP COVERAGE OF SEDIMENT SITES CAN BE QUERIED TO GIVE GRAIN SIZE AND
BEACH SLOPE INFORMATION TO PREDICT EROSION/DEPOSITION RATES, STORM
SURGE INCURSION, TIDAL WATER ELEVATIONS AND WAVE RUN-UP CALCULATIONS.

COMPREHENSIVE COASTAL INVENTORY
 AVERAGE TIME AND DISC SPACE USED*
 SEDIMENT INVENTORY COVERAGE

MAP NUMBER	TIME	DISC SPACE
SED5413	.25	49152
SED5414	.5	57344
SED5512	2.0	53248
SED5513	.75	57344
SED5514	.25	57344
SED5515	.25	49152
SED5612	.25	30720
SED5614	.5	57344
SED5711	.75	24576
SED5713	1.0	57344
SED5714	.5	57344
SED5810	.5	61440
SED5811	1.0	49152
SED5813	.5	57344
SED5814	.25	49152
SED5910	1.0	57344
SED5912	.5	24576
SED5913	.25	24576
SED6009	.75	57344
SED6010	1.0	49152
SED6011	.75	26624
SED6012	.75	24576

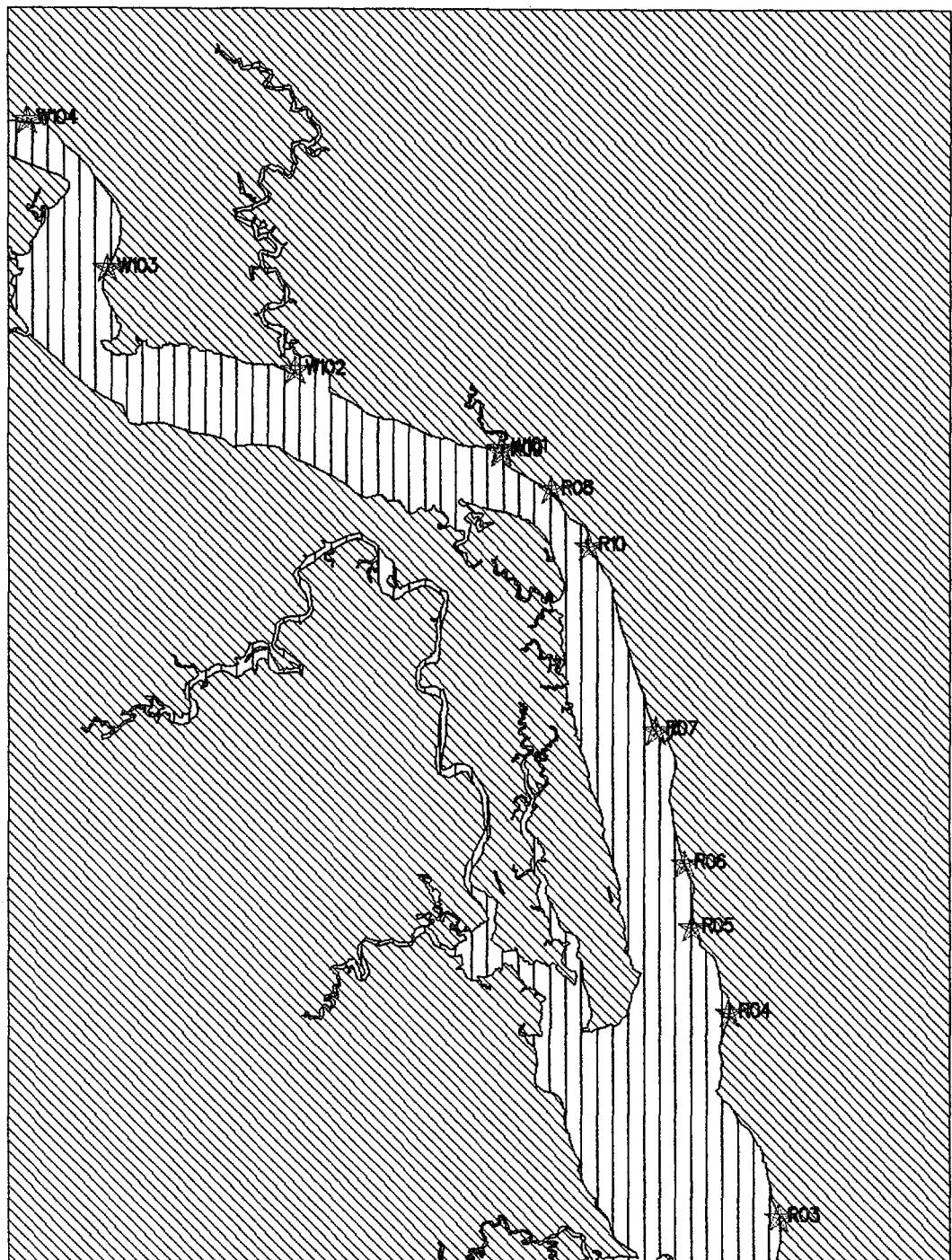
AVERAGE | .75 | 46918

*TIME IN HOURS, DISC SPACE IN BYTES



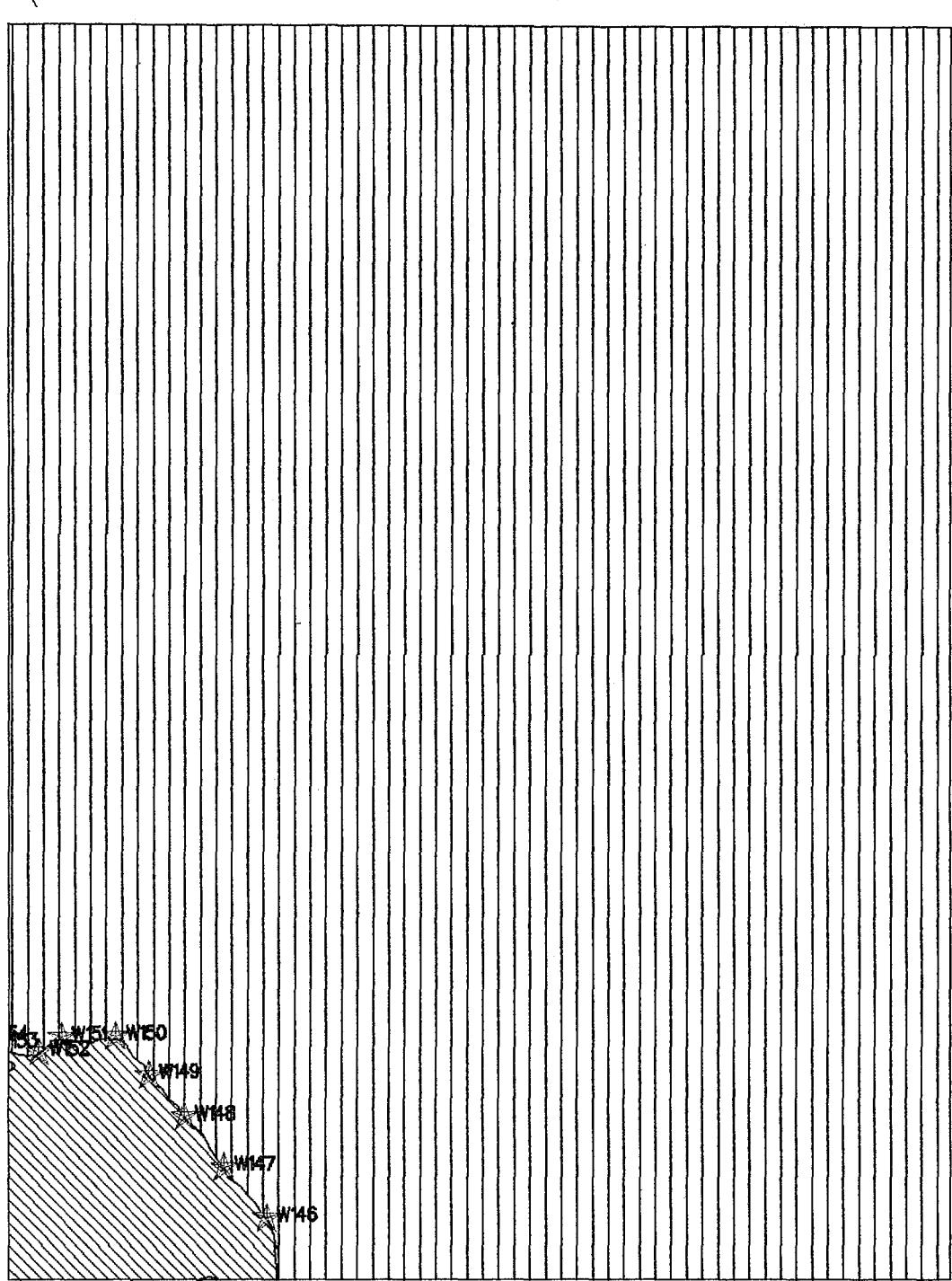
VIMS COASTAL INVENTORIES
SEDIMENT SURVEY
SED6012
BURGESS QUAD

SED6012
★ SAMPLE STATION
/// UPLAND
|| WATER



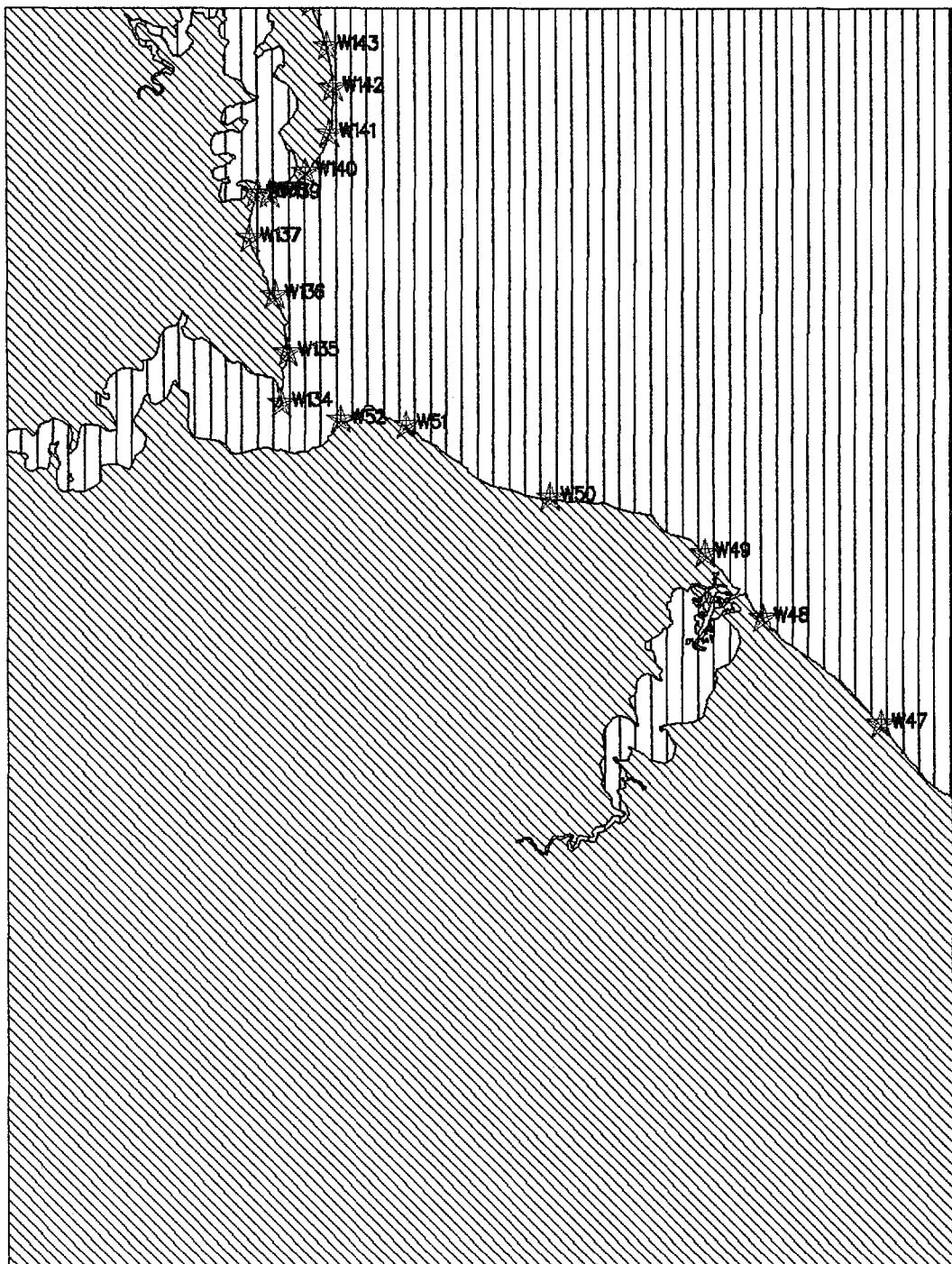
VIMS COASTAL INVENTORIES
SEDIMENT SURVEY
SED5513
CHAMPLAIN QUAD

SED5513
★ SAMPLE STATION
/// UPLAND
|| WATER



VIMS COASTAL INVENTORIES
SEDIMENT SURVEY
SED5515
COLONIAL BEACH NORTH QUAD

SED5515
★ SAMPLE STATION
VVV UPLAND
II WATER



VIMS COASTAL INVENTORIES
SEDIMENT SURVEY

SED5514

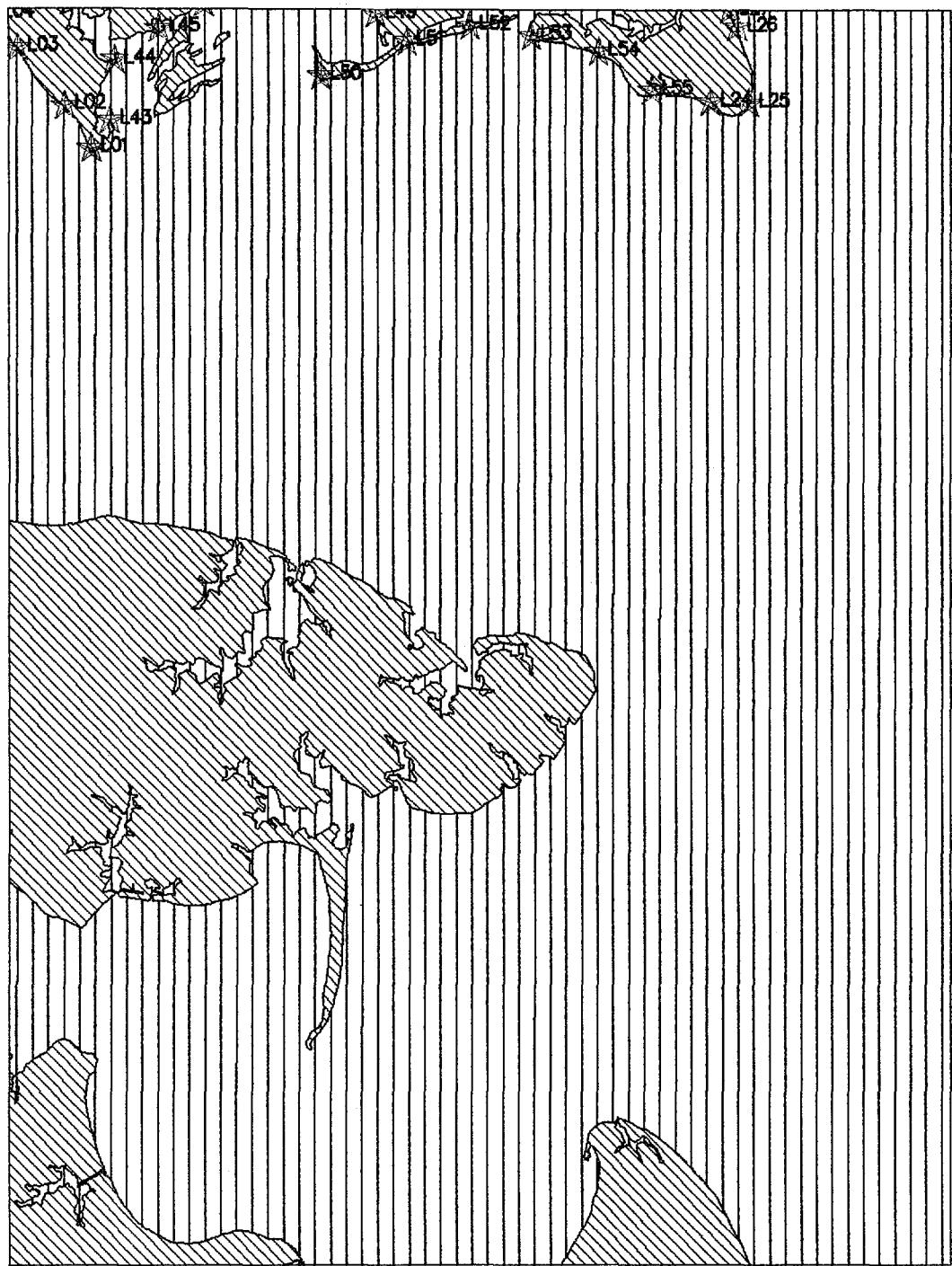
COLONIAL BEACH SOUTH QUAD

SED5514

* SAMPLE STATION

\\\\\\ UPLAND

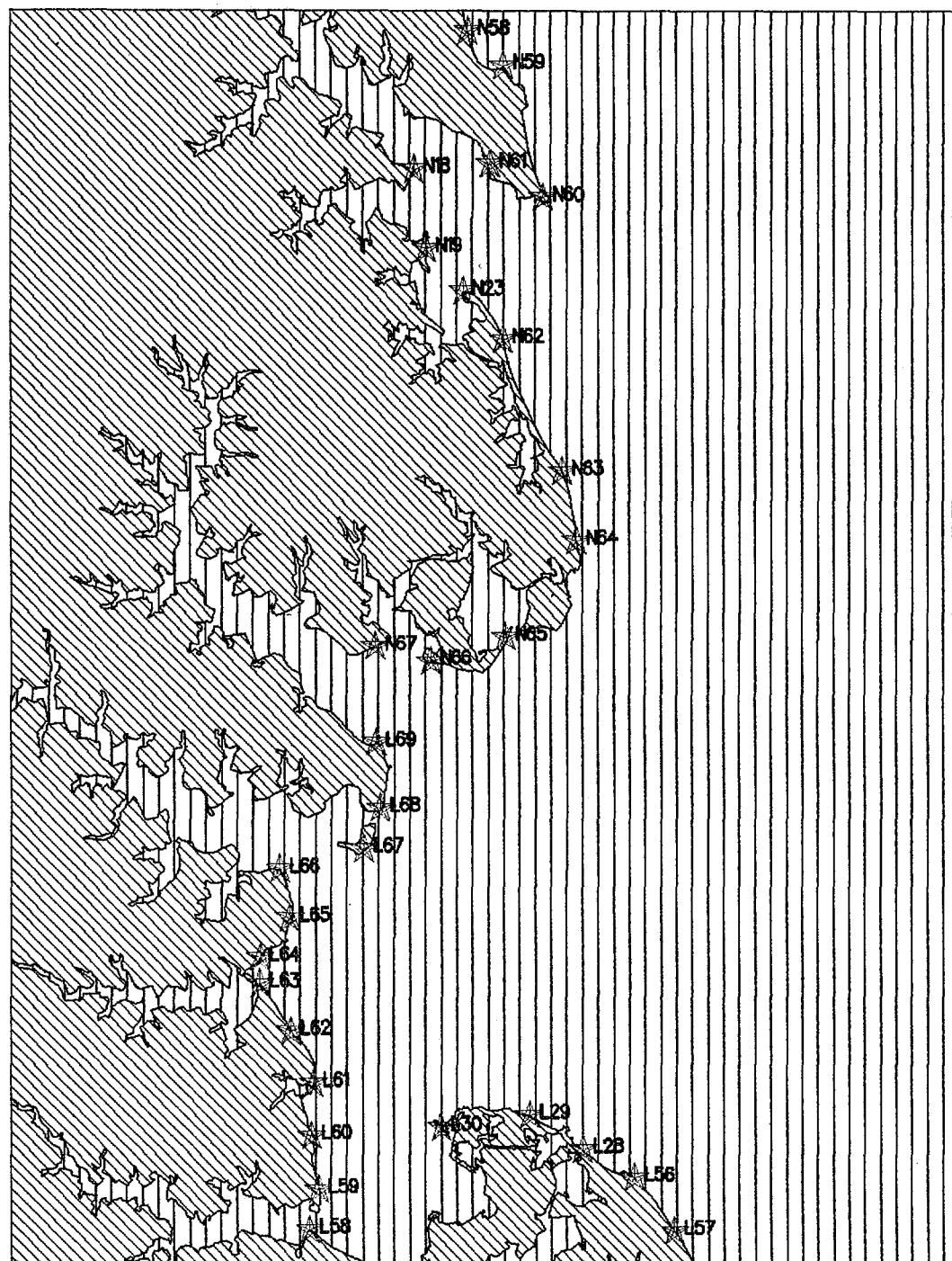
|| WATER



VIMS COASTAL INVENTORIES
SEDIMENT SURVEY
SED 6009
DELTAVILLE QUAD

SED6009

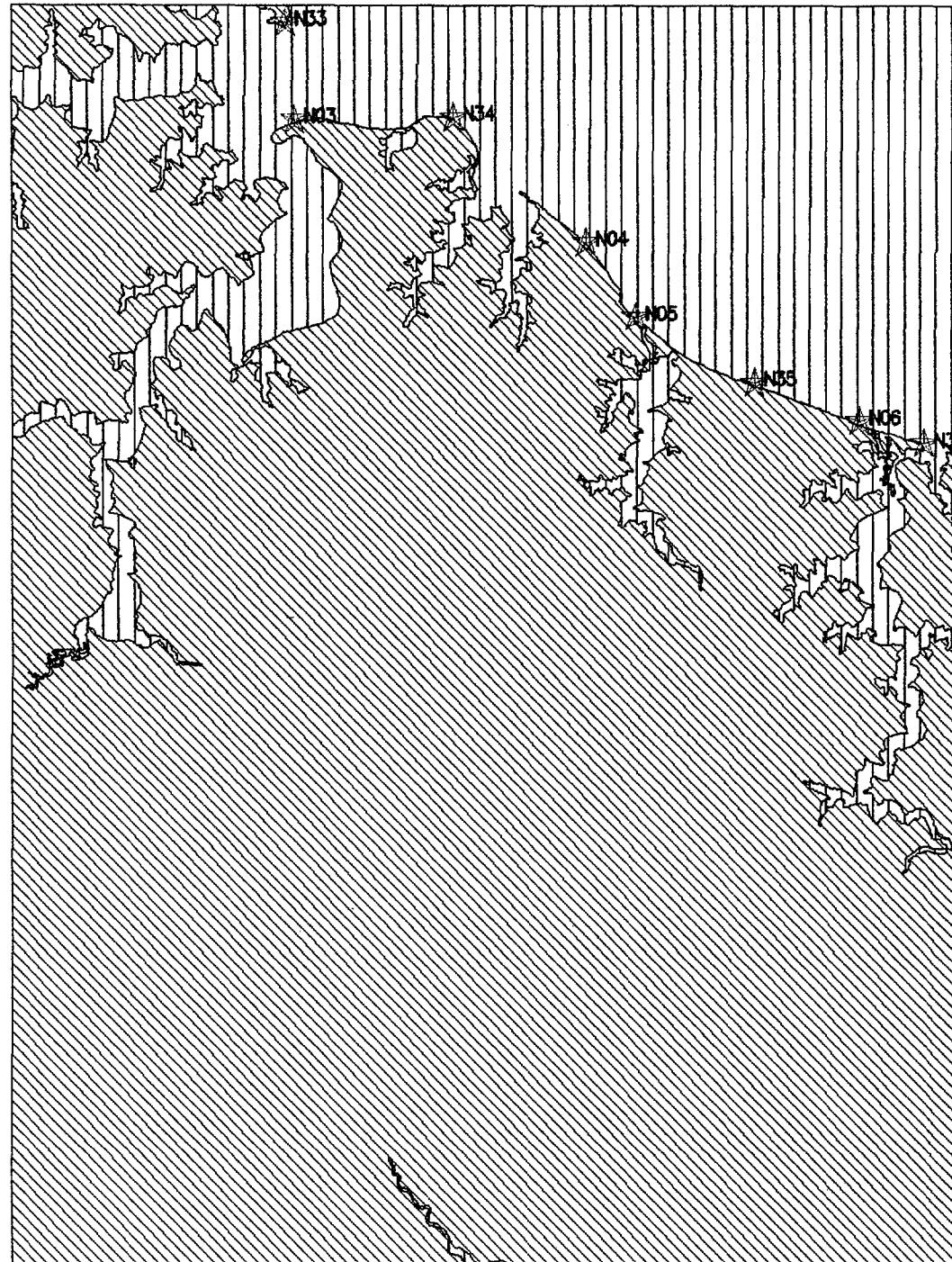
* SAMPLE STATION
VVV UPLAND
II WATER



VIMS COASTAL INVENTORIES
SEDIMENT SURVEY
SED6010
FLEETS BAY QUAD

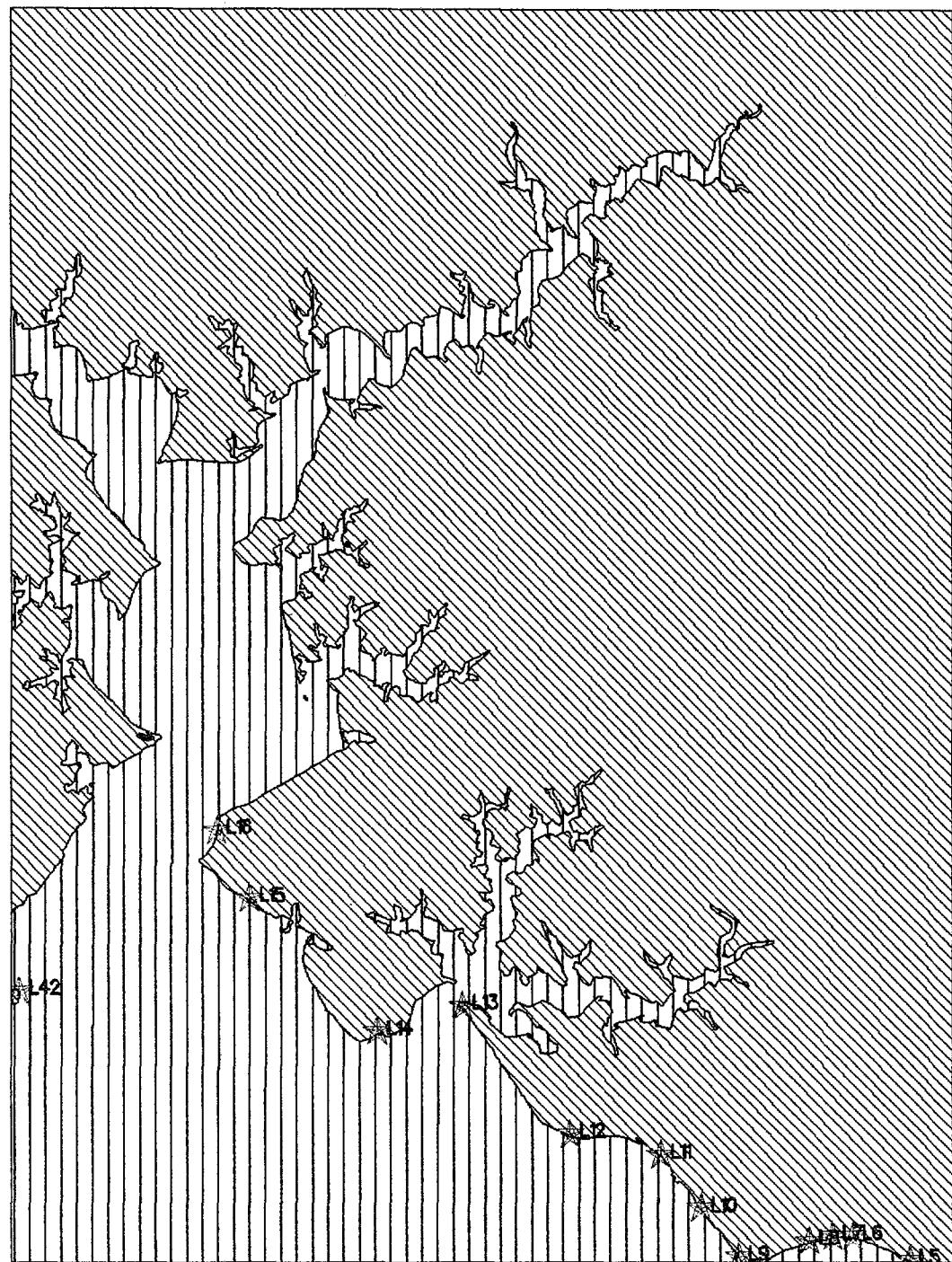
SED6010

* SAMPLE STATION
VVV UPLAND
II WATER



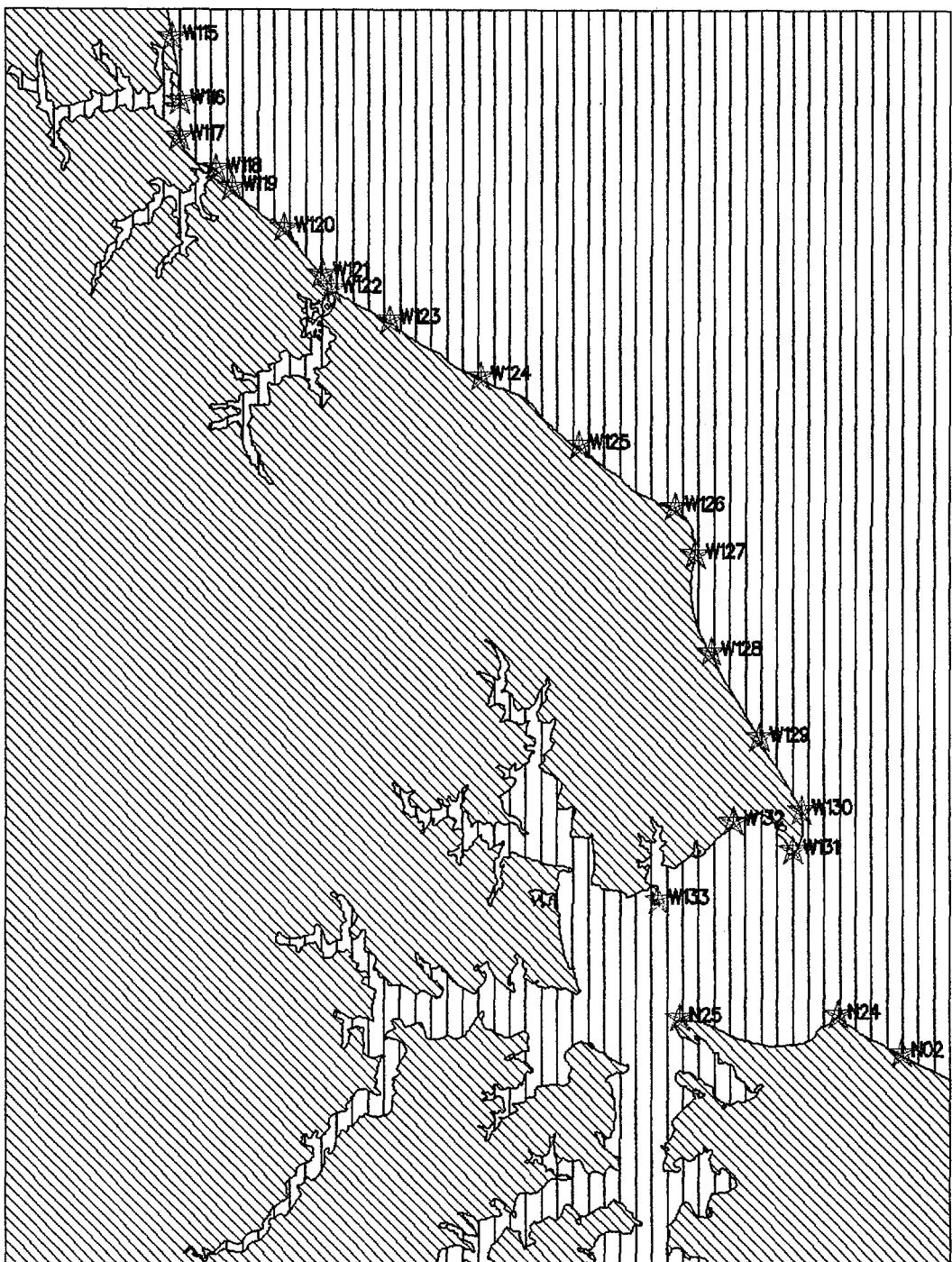
VIMS COASTAL INVENTORIES
SEDIMENT SURVEY
SED5912
HEATHSVILLE QUAD

SED5912
★ SAMPLE STATION
\\\\\\ UPLAND
|| WATER



VIMS COASTAL INVENTORIES
SEDIMENT SURVEY
SED5910
IRVINGTON QUAD

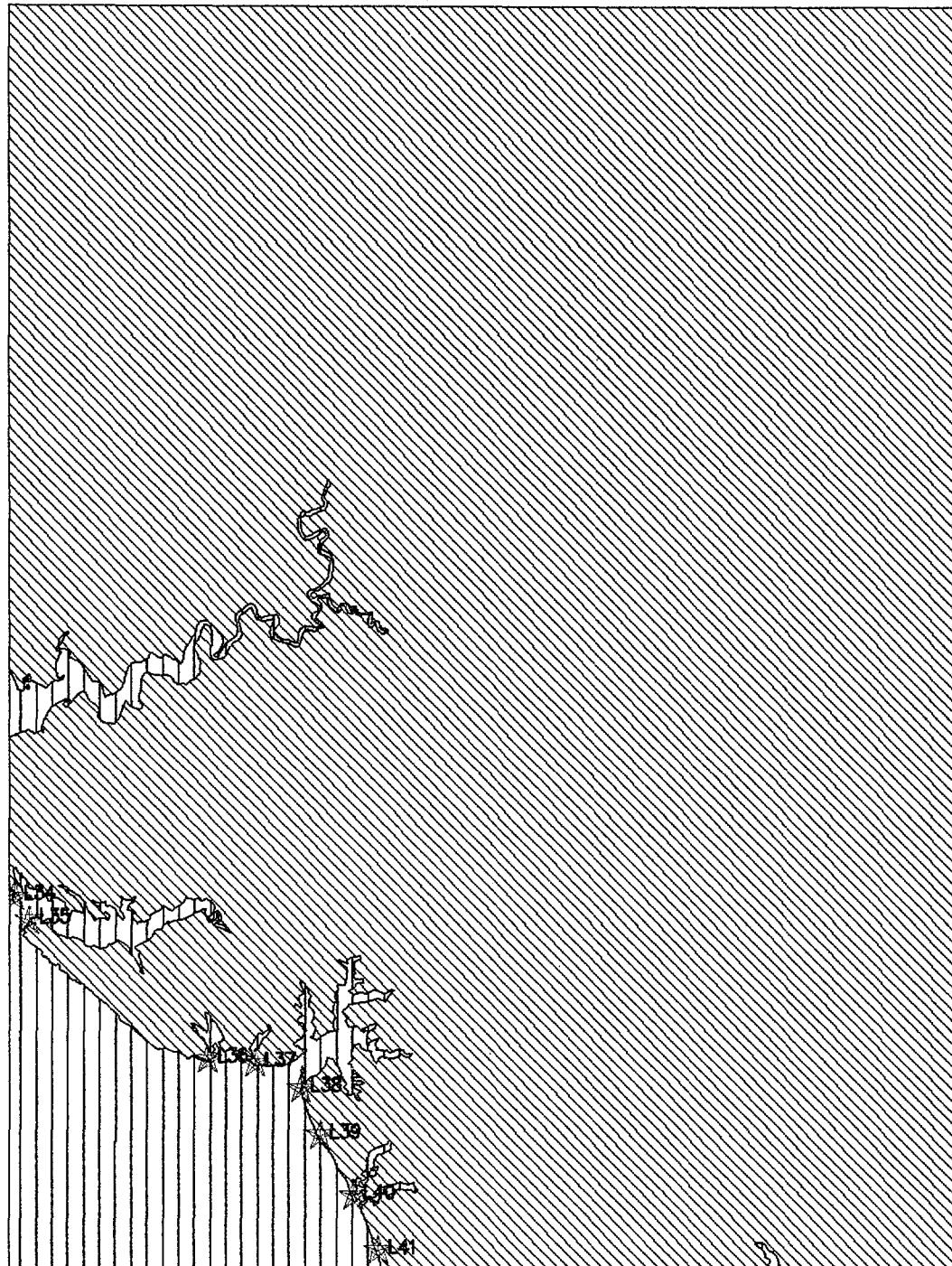
SED5910
* SAMPLE STATION
/// UPLAND
II WATER



VIMS COASTAL INVENTORIES
SEDIMENT SURVEY
SED5813
KINSALE QUAD

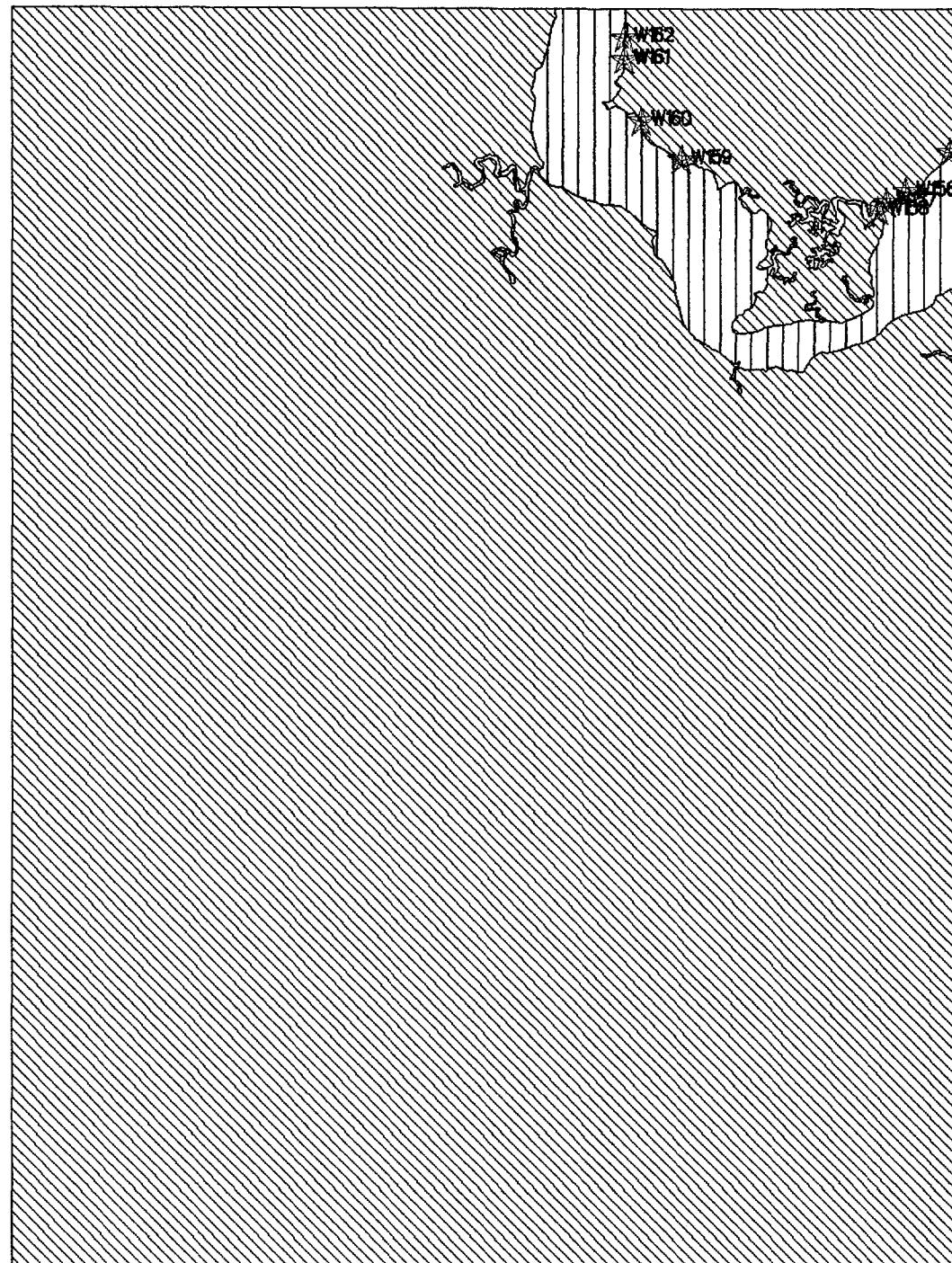
SED5813

* SAMPLE STATION
~~~ UPLAND  
|| WATER



VIMS COASTAL INVENTORIES  
SEDIMENT SURVEY  
SED5811  
LIVELY QUAD

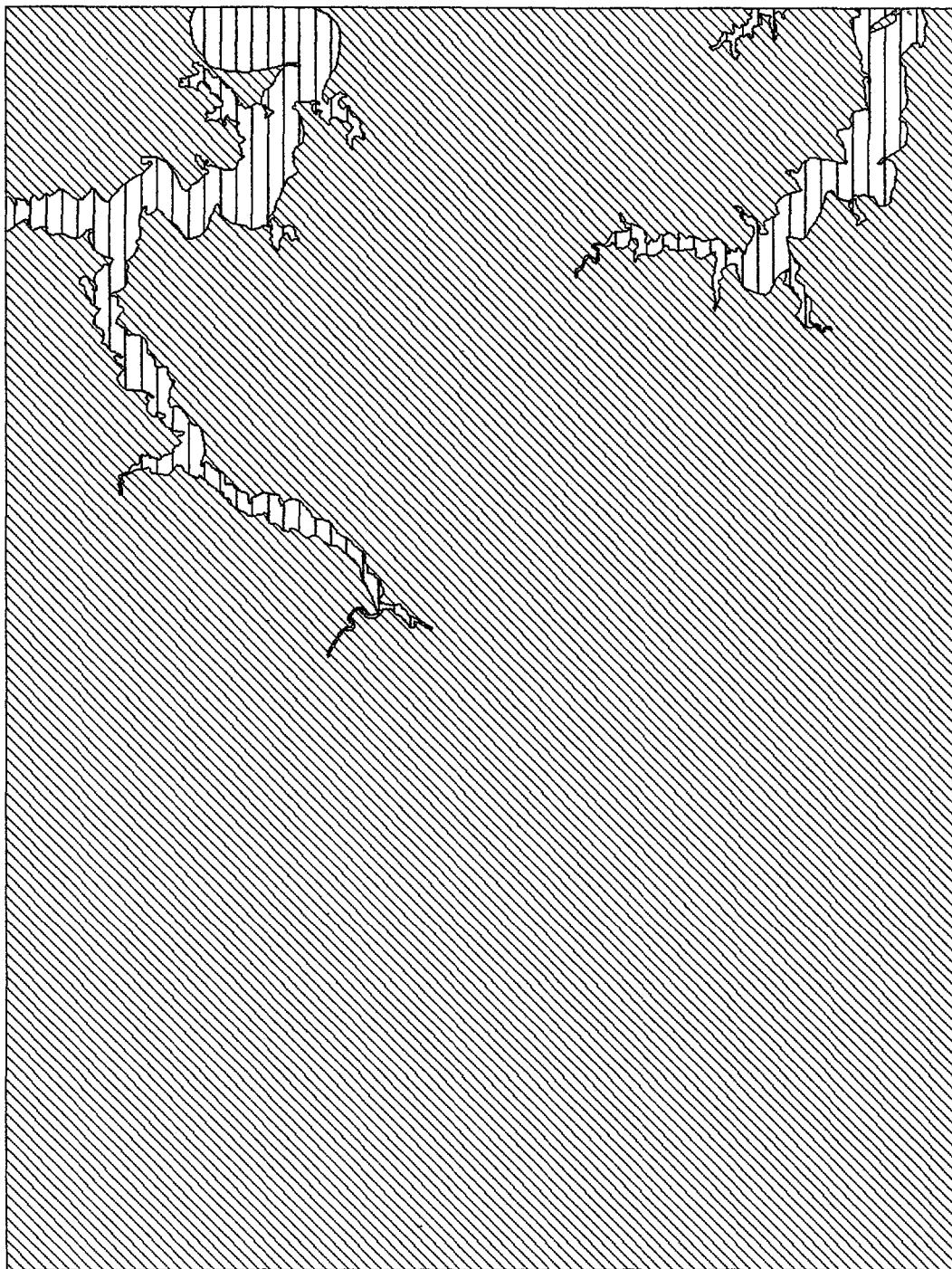
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★ SAMPLE STATION  
VVV UPLAND  
II WATER



VIMS COASTAL INVENTORIES  
SEDIMENT SURVEY  
SED5413  
LORETTO QUAD

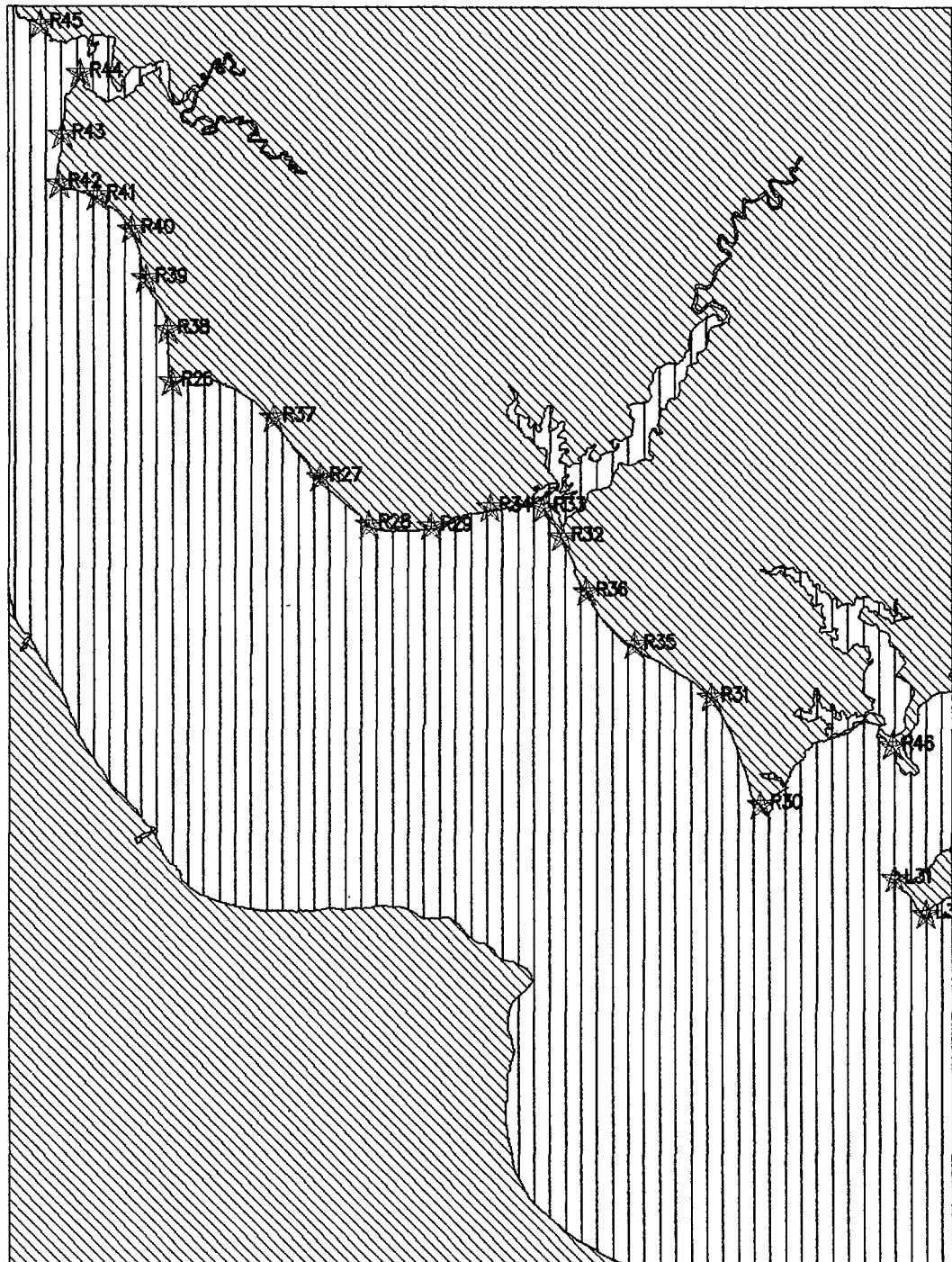
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\* SAMPLE STATION  
/// UPLAND  
|| WATER



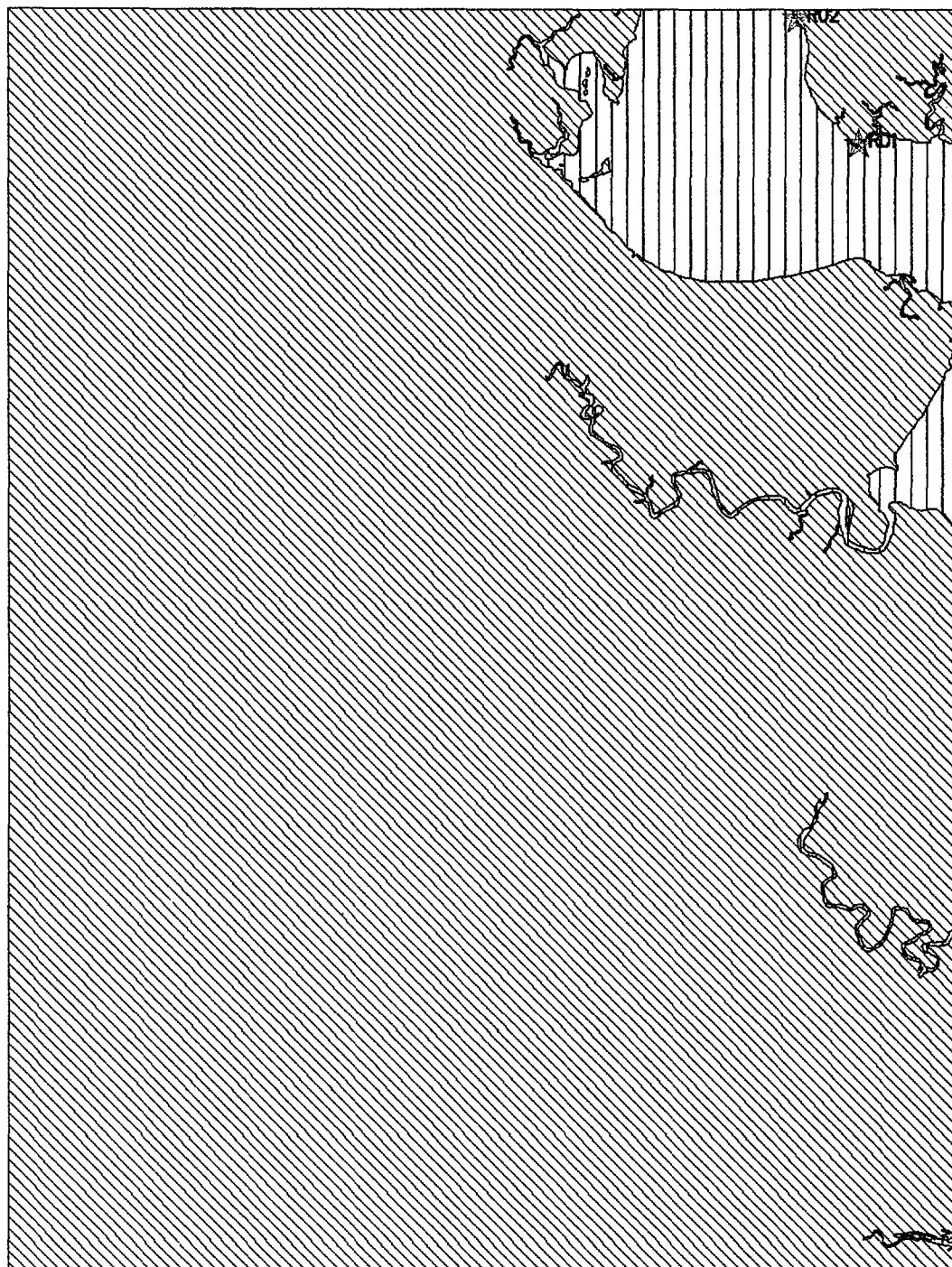
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SEDIMENT SURVEY  
SED5713  
MACHODOC QUAD

SED5713  
★ SAMPLE STATION  
VVV UPLAND  
II WATER



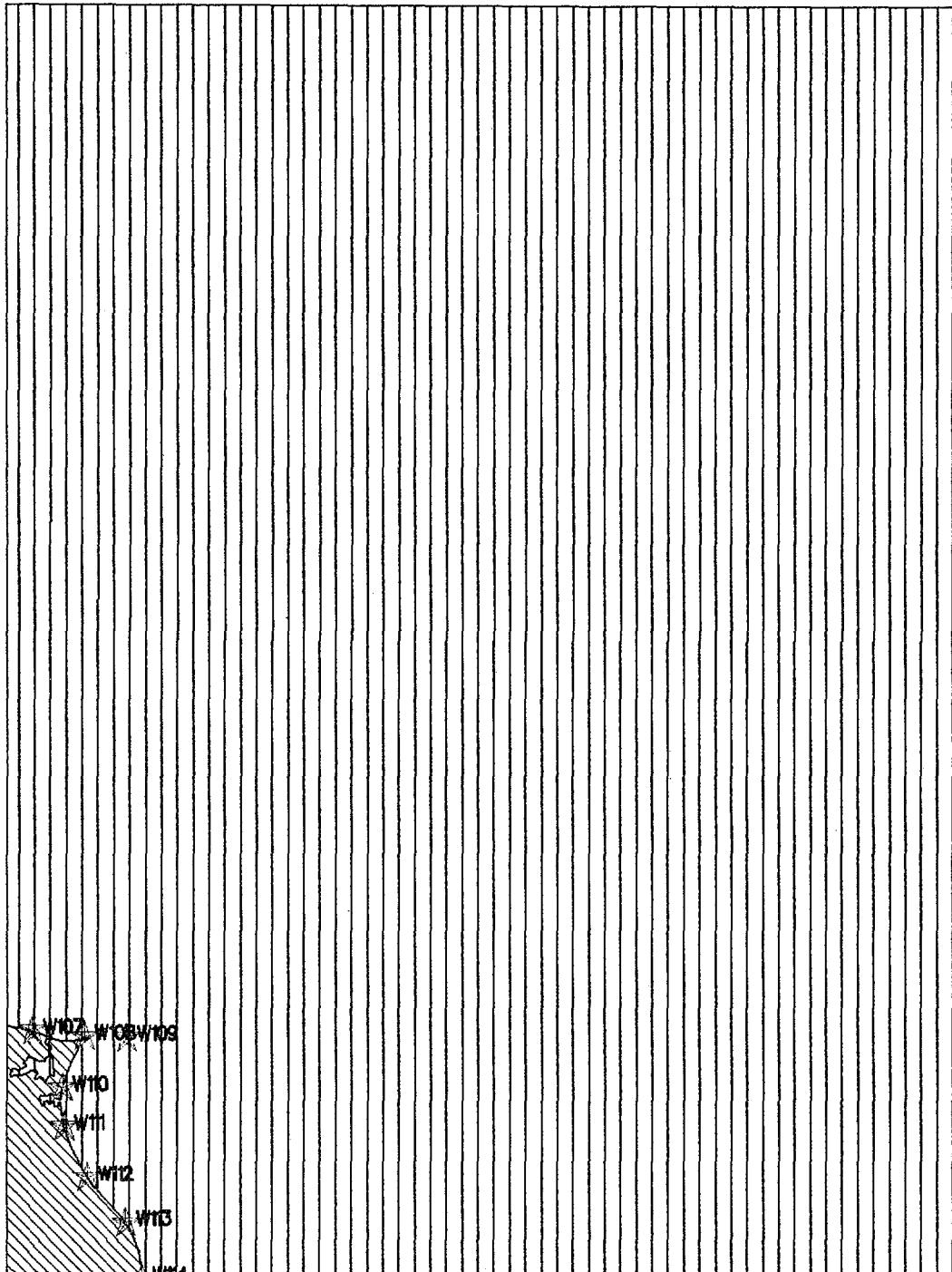
VIMS COASTAL INVENTORIES  
SEDIMENT SURVEY  
SED5711  
MORATTICO QUAD

SED5711  
★ SAMPLE STATION  
\\\\\\ UPLAND  
|| WATER



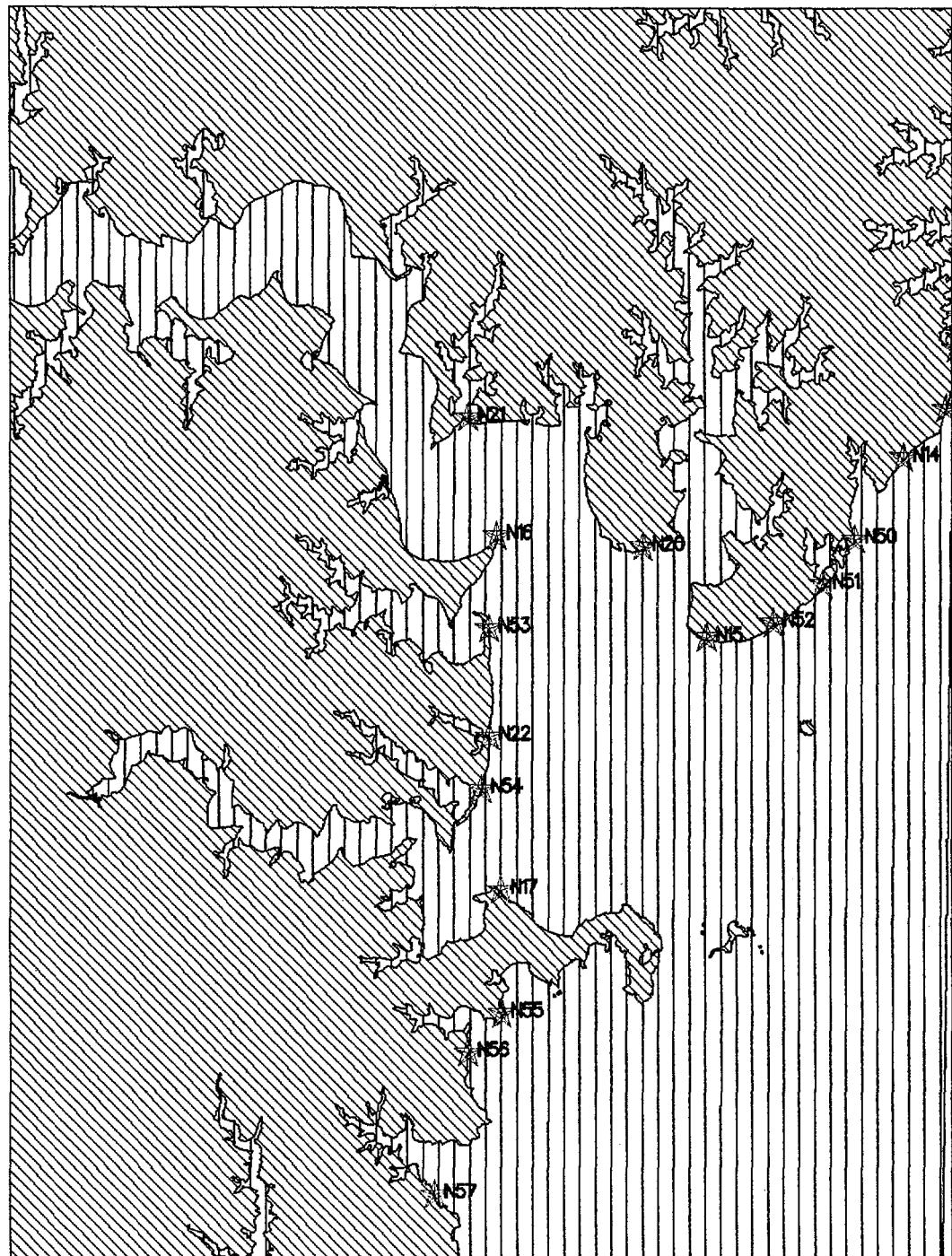
VIMS COASTAL INVENTORIES  
SEDIMENT SURVEY  
SED5512  
MOUNT LANDING QUAD

SED5512  
★ SAMPLE STATION  
VVV UPLAND  
II WATER



VIMS COASTAL INVENTORIES  
SEDIMENT SURVEY  
SED5814  
PINEY POINT QUAD

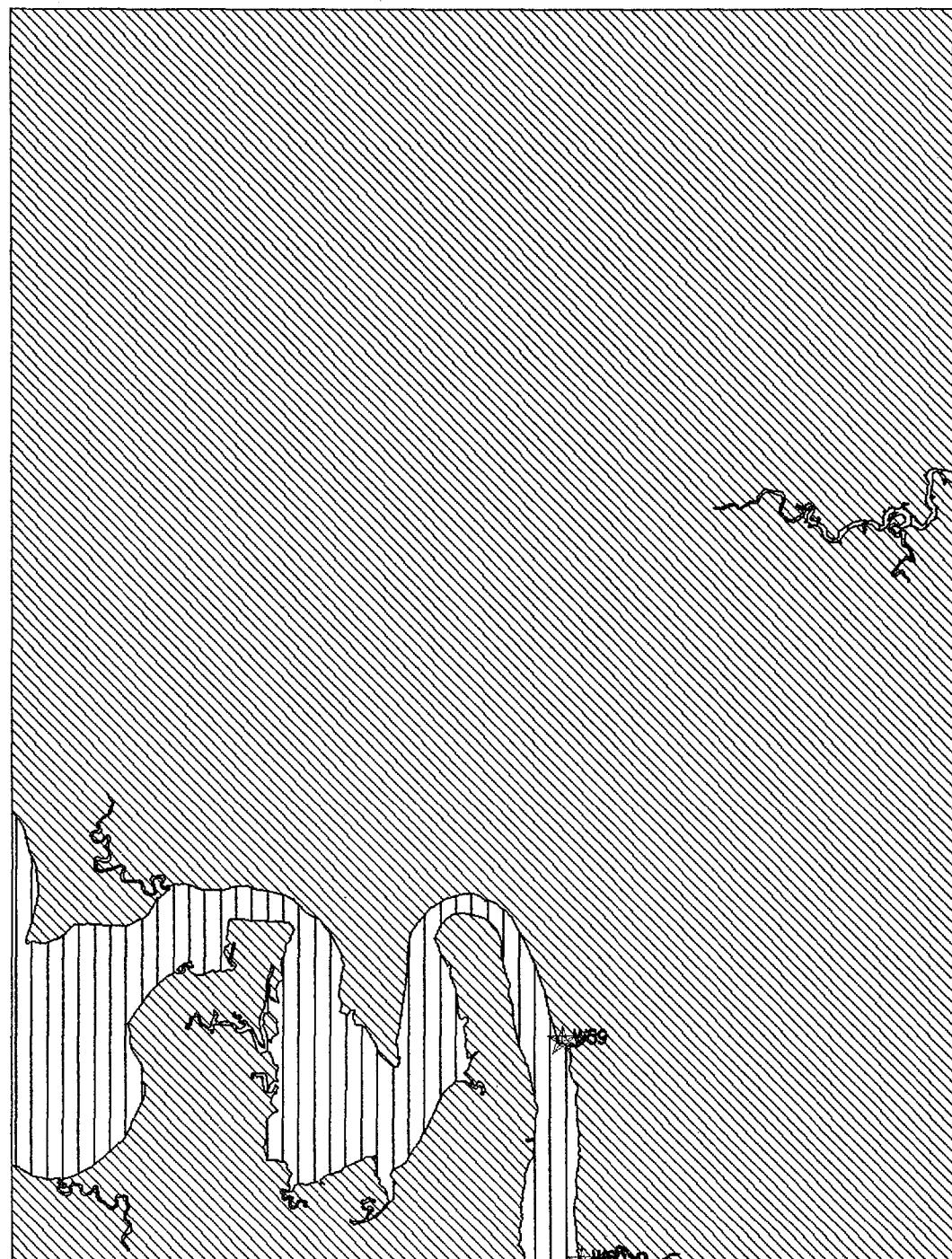
SED5814  
★ SAMPLE STATION  
|||| UPLAND  
|| WATER



VIMS COASTAL INVENTORIES  
SEDIMENT SURVEY  
SED6011  
REEDVILLE QUAD

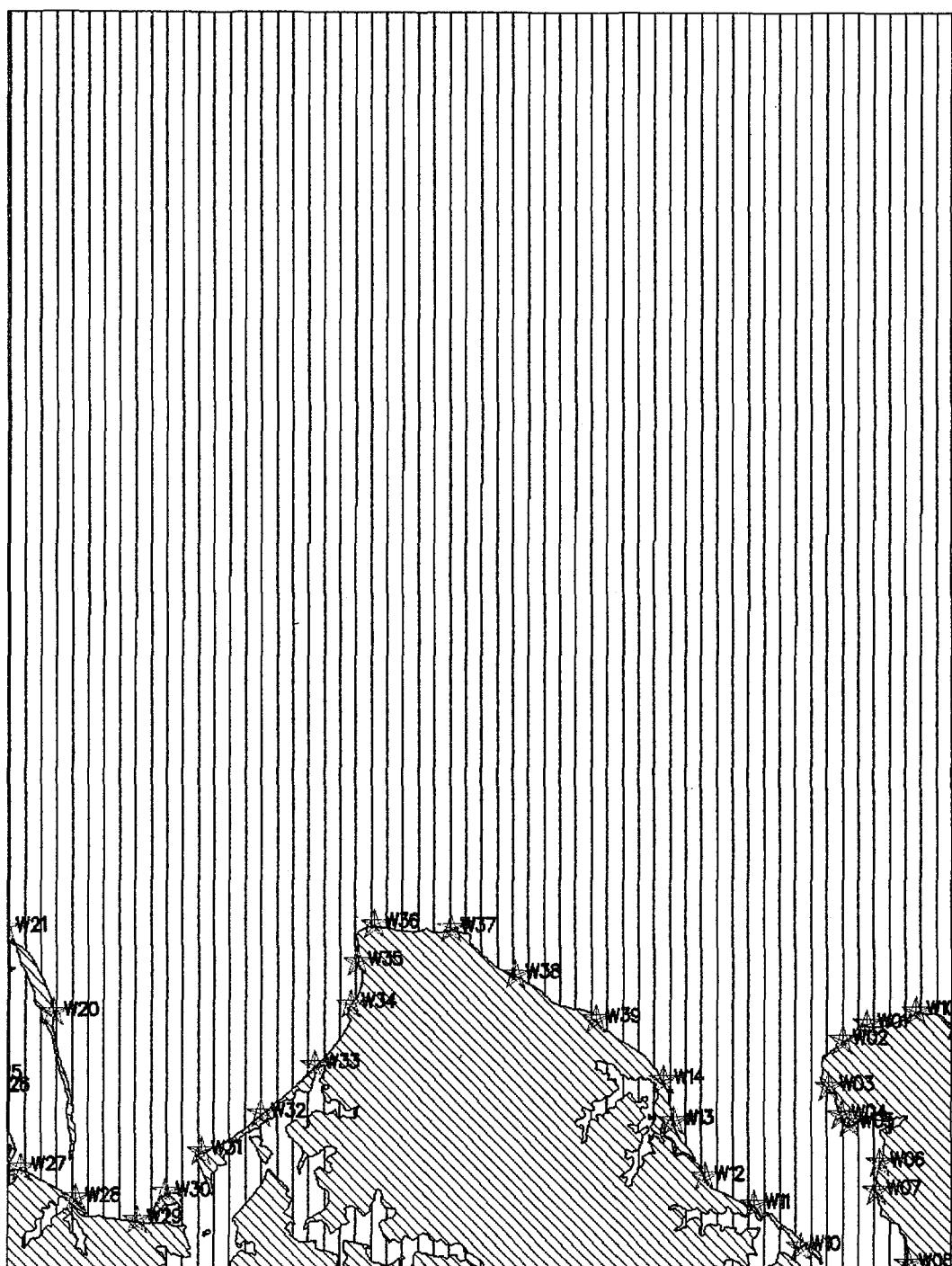
SED6011

★ SAMPLE STATION  
\\\\\\ UPLAND  
|| WATER



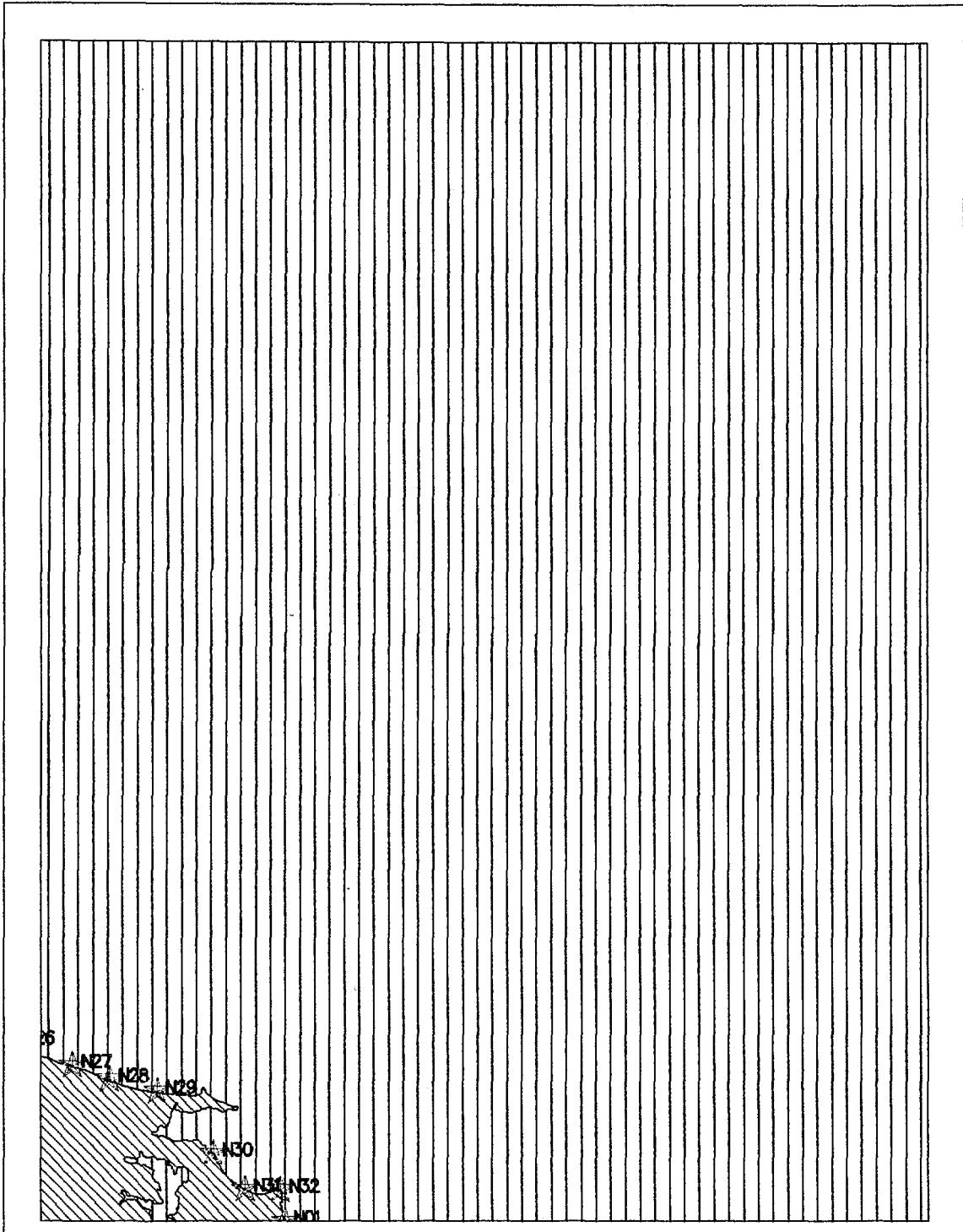
VIMS COASTAL INVENTORIES  
SEDIMENT SURVEY  
SED 5414  
ROLLINS FORK QUAD

SED 5414  
★ SAMPLE STATION  
/// UPLAND  
|| WATER



VIMS COASTAL INVENTORIES  
SEDIMENT SURVEY  
SED5714  
ST CLEMENTS ISLAND QUAD

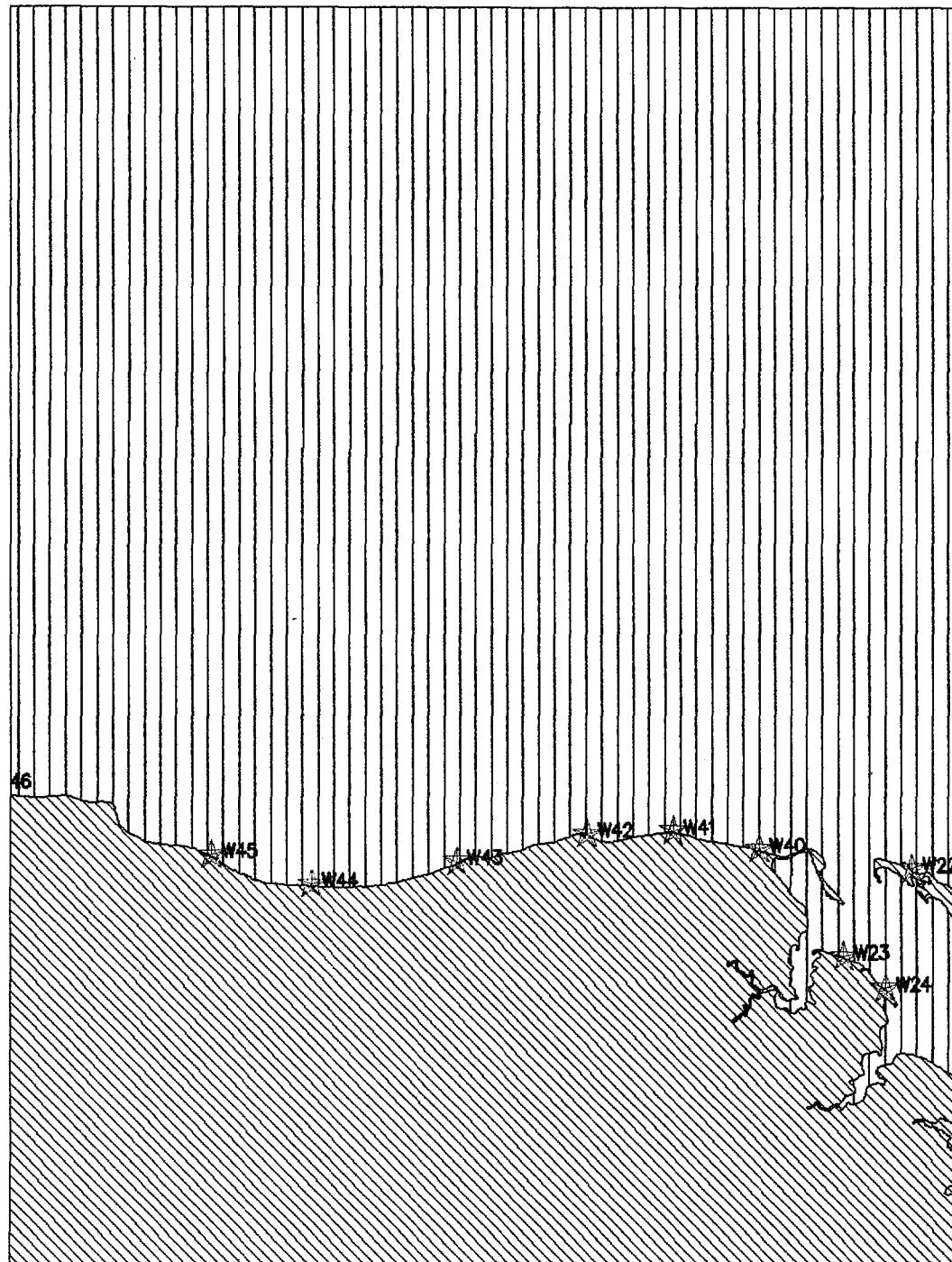
SED5714  
★ SAMPLE STATION  
VVV UPLAND  
|| WATER



VIMS COASTAL INVENTORIES  
SEDIMENT SURVEY  
SED5913  
ST GEORGE ISLAND QUAD

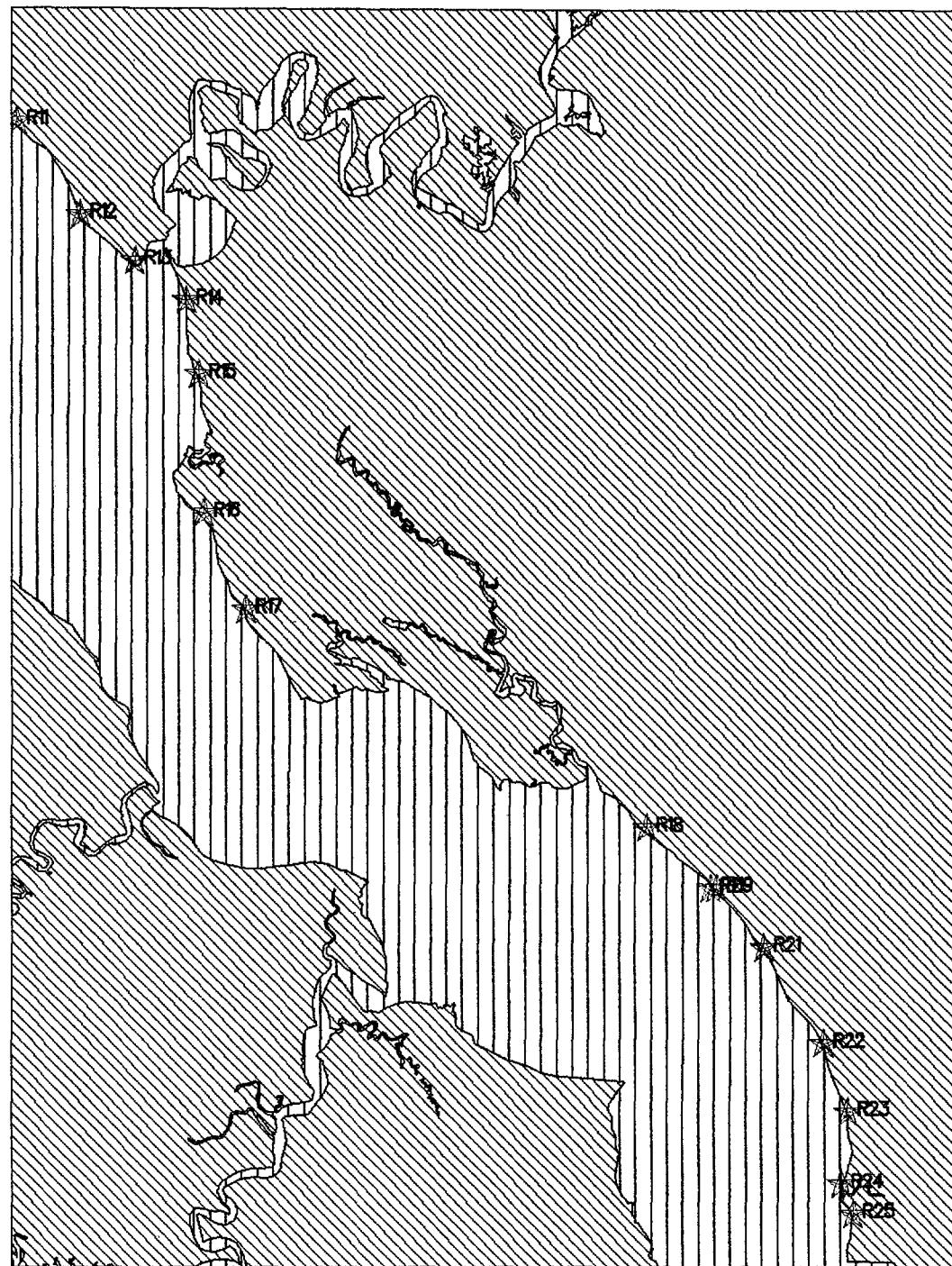
SED5913

\* SAMPLE STATION  
xxx UPLAND  
|| WATER



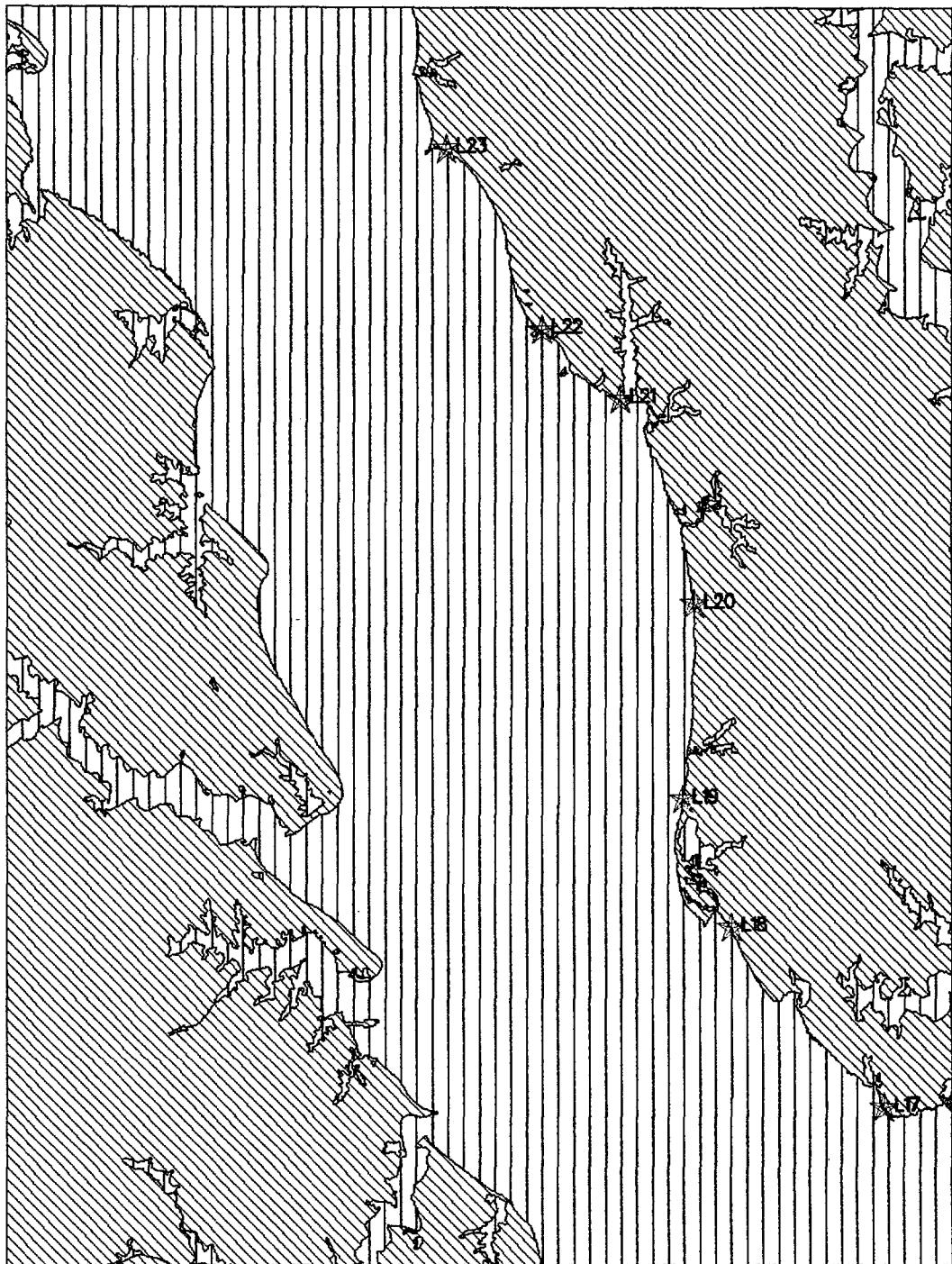
VIMS COASTAL INVENTORIES  
SEDIMENT SURVEY  
SED5614  
STRATFORD HALL QUAD

SED5614  
★ SAMPLE STATION  
~~~~ UPLAND  
|| WATER



VIMS COASTAL INVENTORIES
SEDIMENT SURVEY
SED5612
TAPPAHANNOCK QUAD

SED5612
★ SAMPLE STATION
\\\\\\ UPLAND
||| WATER



VIMS COASTAL INVENTORIES
SEDIMENT SURVEY
SED5810
URBANNA QUAD

SED5810
★ SAMPLE STATION
/// UPLAND
|| WATER

Table 7a. SEDIMENT SURVEY DATA
 GRAIN SIZE PERCENTAGES
 WESTMORELAND COUNTY
 FORESHORE

| STATION | GRAVEL% | SAND% | SILT% | CLAY% |
|---------|---------|-------|-------|-------|
| W1 | 37.5 | 61.8 | 0.7 | 0.0 |
| W2 | 43.3 | 56.0 | 0.7 | 0.0 |
| W3 | 6.4 | 92.9 | 0.7 | 0.0 |
| W4 | 54.9 | 44.6 | 0.5 | 0.0 |
| W5 | 30.6 | 68.6 | 0.8 | 0.0 |
| W6 | 16.1 | 83.1 | 0.8 | 0.0 |
| W7 | 41.7 | 57.6 | 0.7 | 0.0 |
| W8 | 7.3 | 91.4 | 1.3 | 0.0 |
| W9 | 13.9 | 85.1 | 1.0 | 0.0 |
| W10 | 7.8 | 91.6 | 0.6 | 0.0 |
| W11 | 19.3 | 79.7 | 1.0 | 0.0 |
| W12 | 19.6 | 79.6 | 0.8 | 0.0 |
| W13 | 43.2 | 56.0 | 0.8 | 0.0 |
| W14 | 40.4 | 58.6 | 1.0 | 0.0 |
| W20 | 21.5 | 78.0 | 0.5 | 0.0 |
| W21 | 35.2 | 64.4 | 0.4 | 0.0 |
| W22 | 1.5 | 98.1 | 0.4 | 0.0 |
| W23 | 39.7 | 59.5 | 0.8 | 0.0 |
| W24 | 0.9 | 98.5 | 0.6 | 0.0 |
| W25 | 1.2 | 94.4 | 4.4 | 0.0 |
| W26 | 3.4 | 95.1 | 1.5 | 0.0 |
| W27 | 2.9 | 95.3 | 1.8 | 0.0 |
| W28 | 0.0 | 99.4 | 0.6 | 0.0 |
| W29 | 9.2 | 90.4 | 0.4 | 0.0 |
| W30 | 4.8 | 94.8 | 0.4 | 0.0 |
| W31 | 15.6 | 83.8 | 0.6 | 0.0 |
| W32 | 24.1 | 75.5 | 0.4 | 0.0 |
| W33 | 6.9 | 92.6 | 0.5 | 0.0 |
| W34 | 48.3 | 51.4 | 0.3 | 0.0 |
| W35 | 13.3 | 86.2 | 0.5 | 0.0 |
| W36 | 36.4 | 62.9 | 0.7 | 0.0 |
| W37 | 52.9 | 46.7 | 0.4 | 0.0 |
| W38 | 28.0 | 71.1 | 0.9 | 0.0 |
| W39 | 23.1 | 76.3 | 0.6 | 0.0 |
| W40 | 58.3 | 41.4 | 0.3 | 0.0 |
| W41 | 40.0 | 59.4 | 0.6 | 0.0 |
| W42 | 66.1 | 33.2 | 0.7 | 0.0 |
| W43 | 26.9 | 72.6 | 0.5 | 0.0 |
| W44 | 0.0 | 99.5 | 0.5 | 0.0 |
| W45 | 12.2 | 84.1 | 3.7 | 0.0 |
| W46 | 26.9 | 72.7 | 0.4 | 0.0 |

Table 7a. SEDIMENT SURVEY DATA
GRAIN SIZE PERCENTAGES
WESTMORELAND COUNTY
FORESHORE

| STATION | GRAVEL% | SAND% | SILT% | CLAY% |
|---------|---------|-------|-------|-------|
| W47 | 3.8 | 95.8 | 0.4 | 0.0 |
| W48 | 22.5 | 74.1 | 3.4 | 0.0 |
| W49 | 3.3 | 96.1 | 0.6 | 0.0 |
| W50 | 27.8 | 71.7 | 0.5 | 0.0 |
| W51 | 10.5 | 88.5 | 1.0 | 0.0 |
| W52 | 8.9 | 90.0 | 1.1 | 0.0 |
| W59 | 59.1 | 39.9 | 1.0 | 0.0 |
| W60 | 26.3 | 71.9 | 1.8 | 0.0 |
| W101 | 8.9 | 89.2 | 1.9 | 0.0 |
| W102 | 33.3 | 64.2 | 2.5 | 0.0 |
| W103 | 58.3 | 40.5 | 1.2 | 0.0 |
| W104 | 0.2 | 98.1 | 1.7 | 0.0 |

Table 7b. SEDIMENT SURVEY DATA
 GRAIN SIZE STATISTICS
 WESTMORELAND COUNTY
 FORESHORE

| STATION | G_MEDIAN | G_MEAN | G_STDEV | G_SKEWNESS | G_KURTOSIS | M_MEAN | M_STDEV | M_SKew | M_KURT |
|---------|----------|---------|---------|------------|------------|---------|---------|---------|---------|
| W1 | 1.2718 | 1.1362 | 0.6257 | -0.3174 | 0.7220 | 1.1218 | 0.6964 | -0.5998 | 4.3659 |
| W2 | 1.1147 | 0.9987 | 0.5682 | -0.2314 | 0.7263 | 1.0119 | 0.6114 | -0.0110 | 4.4987 |
| W3 | 1.3979 | 1.3651 | 0.3456 | -0.2492 | 0.4963 | 1.3214 | 0.4611 | -1.7750 | 9.9042 |
| W4 | 1.0903 | 0.9371 | 0.6239 | -0.3413 | 0.7649 | 0.9654 | 0.6358 | -0.2046 | 4.1549 |
| W5 | 1.1148 | 1.0408 | 0.5770 | -0.1149 | 0.7471 | 1.0634 | 0.5995 | 0.0222 | 3.8523 |
| W6 | 0.7696 | 0.7199 | 0.6748 | -0.1367 | 0.8083 | 0.7065 | 0.6909 | -0.1205 | 2.7485 |
| W7 | 1.1853 | 1.1132 | 0.5733 | -0.1324 | 0.7255 | 1.1463 | 0.5907 | 0.1156 | 4.3104 |
| W8 | 1.1287 | 1.0504 | 0.5427 | -0.2896 | 0.7954 | 1.0274 | 0.5728 | -0.6749 | 4.1354 |
| W9 | 0.8963 | 1.0304 | 1.0289 | 0.1281 | 0.7609 | 1.0177 | 0.9680 | 0.1135 | 2.1891 |
| W10 | 0.9327 | 0.8121 | 0.7568 | -0.1698 | 0.7768 | 0.8572 | 0.7240 | -0.0826 | 2.6179 |
| W11 | 0.8169 | 0.8234 | 0.5051 | 0.0274 | 0.8808 | 0.8321 | 0.5642 | 0.6555 | 5.5918 |
| W12 | 1.0104 | 0.8353 | 0.6472 | -0.3571 | 0.7271 | 0.8661 | 0.6681 | -0.1041 | 3.8087 |
| W13 | 0.8902 | 0.8141 | 0.5131 | -0.2620 | 0.8043 | 0.8225 | 0.5970 | 0.2310 | 6.7119 |
| W14 | 0.7440 | 0.6555 | 0.6855 | -0.1554 | 0.7666 | 0.6766 | 0.6846 | 0.0091 | 2.9637 |
| W20 | 0.1460 | 0.0575 | 0.4901 | -0.2388 | 1.2235 | 0.0533 | 0.5445 | 0.8694 | 6.9049 |
| W21 | -0.1726 | -0.1934 | 0.4283 | -0.0640 | 1.8378 | -0.1504 | 0.4999 | 1.2024 | 8.6459 |
| W22 | 0.5115 | 0.5307 | 0.4007 | 0.0262 | 0.8173 | 0.5476 | 0.4770 | 1.4610 | 10.3546 |
| W23 | 0.7979 | 1.0065 | 1.1384 | 0.2465 | 1.0988 | 0.9243 | 1.0105 | 0.6410 | 2.5830 |
| W24 | 0.9224 | 0.9076 | 0.4273 | -0.0876 | 0.6787 | 0.9121 | 0.4878 | 0.4855 | 6.1871 |
| W25 | 0.8743 | 1.0344 | 0.6704 | 0.3739 | 0.8489 | 1.0485 | 0.6840 | 0.7991 | 3.2988 |
| W26 | 0.8832 | 0.8757 | 0.4975 | -0.0492 | 0.7704 | 0.8705 | 0.5498 | -0.0292 | 5.1268 |
| W27 | 1.4472 | 1.5007 | 0.8792 | 0.0120 | 0.6118 | 1.4714 | 0.8704 | -0.1383 | 2.4234 |
| W28 | 1.0217 | 1.0684 | 0.4608 | 0.1452 | 0.6320 | 1.0684 | 0.4900 | 0.3836 | 4.4473 |
| W29 | 0.4958 | 0.4368 | 0.7320 | -0.0199 | 1.2879 | 0.5118 | 0.7546 | 0.7147 | 4.6317 |
| W30 | 0.7961 | 0.7906 | 0.3582 | -0.0290 | 0.6528 | 0.8112 | 0.4455 | 1.1283 | 8.9187 |
| W31 | 0.5993 | 0.5574 | 0.7014 | 0.0580 | 1.3959 | 0.6232 | 0.7351 | 1.0133 | 5.2784 |

Table 7b. SEDIMENT SURVEY DATA
GRAIN SIZE STATISTICS
WESTMORELAND COUNTY
FORESHORE

| STATION | G_MEDIAN | G_MEAN | G_STDEV | G_SKEWN | G_KURTO | M_MEAN | M_STDEV | M_SKW | M_KURT |
|---------|----------|---------|---------|---------|---------|---------|---------|---------|---------|
| W32 | 0.9495 | 0.9900 | 0.5939 | 0.2172 | 0.9429 | 1.0384 | 0.6451 | 1.0202 | 5.1440 |
| W33 | 0.9663 | 0.9921 | 0.7236 | 0.1064 | 1.0488 | 1.0330 | 0.7198 | 0.4920 | 3.6153 |
| W34 | 0.9882 | 0.9749 | 0.5612 | -0.0372 | 0.6818 | 0.9801 | 0.6341 | 0.0123 | 4.3824 |
| W35 | 1.2212 | 1.1897 | 0.4707 | -0.1905 | 0.6698 | 1.1531 | 0.5351 | -1.1216 | 6.1884 |
| W36 | 0.8683 | 0.8259 | 0.4850 | -0.0708 | 0.7640 | 0.8467 | 0.5394 | 0.1024 | 4.7719 |
| W37 | 0.6777 | 0.5105 | 0.7516 | -0.2776 | 0.9594 | 0.5625 | 0.8005 | 0.3633 | 4.3660 |
| W38 | 1.1296 | 1.0789 | 0.5610 | -0.2102 | 0.8896 | 1.0587 | 0.5822 | -0.6143 | 4.2596 |
| W39 | 0.9230 | 0.8829 | 0.4065 | -0.2122 | 0.7241 | 0.8743 | 0.4436 | -0.0954 | 5.2938 |
| W40 | 0.3265 | 0.2287 | 0.8316 | 0.0270 | 1.4474 | 0.3448 | 0.8723 | 1.1182 | 4.8838 |
| W41 | 0.5346 | 0.4647 | 0.8323 | 0.0010 | 1.1018 | 0.5495 | 0.8683 | 0.7498 | 4.0120 |
| W42 | 0.5379 | 0.5061 | 0.8397 | 0.1140 | 1.4485 | 0.6184 | 0.8919 | 1.1311 | 4.5506 |
| W43 | 0.3282 | 0.2893 | 0.4896 | -0.0431 | 1.0783 | 0.3747 | 0.7133 | 2.3285 | 11.5625 |
| W44 | 1.0316 | 1.0964 | 0.3553 | 0.3249 | 0.5253 | 1.1215 | 0.4343 | 1.5964 | 9.3600 |
| W45 | 0.9118 | 0.8282 | 0.8657 | -0.1371 | 1.0303 | 0.8511 | 0.8609 | 0.0216 | 3.3433 |
| W46 | -0.1757 | -0.1905 | 0.4394 | 0.0137 | 2.1910 | -0.1582 | 0.4907 | 1.6710 | 10.5263 |
| W47 | 0.6854 | 0.6160 | 0.4365 | -0.2294 | 0.7480 | 0.6295 | 0.4927 | 0.5881 | 7.8986 |
| W48 | 0.8812 | 0.7661 | 0.8413 | -0.1433 | 0.8466 | 0.8024 | 0.8858 | 0.3885 | 3.4143 |
| W49 | 0.8477 | 0.6594 | 0.6750 | -0.3428 | 0.7104 | 0.6623 | 0.7363 | 0.3208 | 3.8131 |
| W50 | 0.8416 | 0.7253 | 0.4392 | -0.4454 | 0.7825 | 0.7502 | 0.5605 | 0.8184 | 9.2915 |
| W51 | 1.1545 | 1.1246 | 0.5408 | -0.1039 | 0.8023 | 1.1179 | 0.5990 | -0.1867 | 4.8073 |
| W52 | 1.2130 | 1.1598 | 0.6389 | -0.2401 | 0.8800 | 1.1193 | 0.6725 | -0.9459 | 4.6325 |
| W59 | 0.8589 | 0.8344 | 0.7422 | 0.0145 | 1.0958 | 0.8684 | 0.7678 | 0.5832 | 4.4084 |
| W60 | 0.5845 | 0.5543 | 0.8587 | 0.0919 | 1.3360 | 0.6416 | 0.8738 | 1.0077 | 4.7568 |
| W101 | 0.4948 | 0.5583 | 0.7600 | 0.1402 | 0.7889 | 0.6042 | 0.8147 | 0.8285 | 4.1308 |
| W102 | 1.3860 | 1.1854 | 0.7877 | -0.3802 | 0.7107 | 1.2050 | 0.8091 | -0.4215 | 3.1595 |
| W103 | 0.9181 | 0.7762 | 0.7410 | -0.2757 | 0.8021 | 0.7886 | 0.7510 | -0.1412 | 3.2338 |
| W104 | 0.8794 | 0.8689 | 0.5203 | -0.0249 | 0.6518 | 0.8762 | 0.5712 | 0.1570 | 4.6656 |

Table 8a. SEDIMENT SURVEY DATA
 GRAIN SIZE PERCENTAGES
 WESTMORELAND COUNTY
 BACKSHORE

| STATION | GRAVEL% | SAND% | SILT% | CLAY% |
|---------|---------|-------|-------|-------|
| W1 | 2.5 | 96.6 | 0.9 | 0.0 |
| W2 | 88.4 | 10.6 | 1.0 | 0.0 |
| W3 | 0.0 | 98.9 | 1.1 | 0.0 |
| W4 | 33.5 | 65.7 | 0.8 | 0.0 |
| W5 | 4.7 | 94.9 | 0.4 | 0.0 |
| W6 | 0.0 | 98.9 | 1.1 | 0.0 |
| W7 | 1.4 | 97.6 | 1.0 | 0.0 |
| W8 | 5.9 | 93.4 | 0.7 | 0.0 |
| W9 | 0.5 | 98.5 | 1.0 | 0.0 |
| W10 | 0.0 | 99.1 | 0.9 | 0.0 |
| W11 | 0.0 | 99.4 | 0.6 | 0.0 |
| W12 | 18.9 | 80.7 | 0.4 | 0.0 |
| W13 | 0.2 | 99.1 | 0.7 | 0.0 |
| W14 | 0.0 | 98.7 | 1.3 | 0.0 |
| W20 | 5.4 | 94.0 | 0.6 | 0.0 |
| W21 | 0.8 | 98.4 | 0.8 | 0.0 |
| W22 | 0.0 | 99.7 | 0.3 | 0.0 |
| W23 | 0.0 | 99.1 | 0.9 | 0.0 |
| W24 | 0.0 | 99.7 | 0.3 | 0.0 |
| W25 | 0.0 | 99.4 | 0.6 | 0.0 |
| W26 | 0.0 | 99.1 | 0.9 | 0.0 |
| W27 | 0.0 | 98.4 | 1.6 | 0.0 |
| W28 | 2.7 | 96.6 | 0.7 | 0.0 |
| W29 | 0.0 | 98.8 | 1.2 | 0.0 |
| W30 | 0.0 | 99.6 | 0.4 | 0.0 |
| W31 | 0.0 | 99.6 | 0.4 | 0.0 |
| W32 | 0.0 | 99.3 | 0.7 | 0.0 |
| W33 | 0.1 | 99.2 | 0.7 | 0.0 |
| W34 | 3.0 | 96.5 | 0.5 | 0.0 |
| W35 | 64.1 | 35.6 | 0.3 | 0.0 |
| W36 | 0.0 | 99.4 | 0.6 | 0.0 |
| W37 | 47.6 | 52.1 | 0.3 | 0.0 |
| W38 | 0.0 | 99.1 | 0.9 | 0.0 |
| W39 | 13.5 | 86.1 | 0.4 | 0.0 |
| W40 | 10.3 | 89.5 | 0.2 | 0.0 |
| W41 | 3.4 | 95.9 | 0.7 | 0.0 |
| W42 | 0.4 | 99.1 | 0.5 | 0.0 |
| W43 | 0.0 | 99.5 | 0.5 | 0.0 |
| W44 | 46.8 | 52.7 | 0.5 | 0.0 |

**Table 8a. SEDIMENT SURVEY DATA
GRAIN SIZE PERCENTAGES
WESTMORELAND COUNTY
BACKSHORE**

| STATION | GRAVEL% | SAND% | SILT% | CLAY% |
|---------|---------|-------|-------|-------|
| W45 | 9.5 | 75.6 | 14.9 | 0.0 |
| W46 | 0.1 | 99.5 | 0.4 | 0.0 |
| W47 | 30.6 | 69.1 | 0.3 | 0.0 |
| W48 | 1.0 | 98.5 | 0.5 | 0.0 |
| W49 | 41.1 | 58.4 | 0.5 | 0.0 |
| W50 | 0.0 | 99.6 | 0.4 | 0.0 |
| W51 | 0.0 | 99.3 | 0.7 | 0.0 |
| W52 | 0.2 | 99.3 | 0.5 | 0.0 |
| W59 | 0.0 | 98.4 | 1.6 | 0.0 |
| W60 | 0.0 | 98.2 | 1.8 | 0.0 |
| W101 | 0.3 | 97.1 | 2.6 | 0.0 |
| W102 | 2.3 | 94.6 | 3.1 | 0.0 |
| W104 | 2.7 | 95.5 | 1.8 | 0.0 |

Table 8b. SEDIMENT SURVEY DATA
 GRAIN SIZE STATISTICS
 WESTMORELAND COUNTY
 BACKSHORE

| STATION | G_MEDIAN | G_MEAN | G_STDEV | G_SKEWN | G_KURTO | M_MEAN | M_STDEV | M_SKEW | M_KURT |
|---------|----------|--------|---------|---------|---------|--------|---------|---------|---------|
| W1 | 1.5752 | 1.6091 | 0.2894 | 0.1814 | 0.3466 | 1.6079 | 0.3212 | 0.0567 | 6.6958 |
| W2 | 1.1848 | 1.1380 | 0.6741 | -0.0350 | 0.8700 | 1.1655 | 0.6869 | 0.3068 | 3.6100 |
| W3 | 1.4727 | 1.4775 | 0.2445 | 0.0246 | 0.3288 | 1.4707 | 0.3292 | -1.3127 | 17.5485 |
| W4 | 1.2176 | 1.1851 | 0.3740 | -0.1427 | 0.5465 | 1.1694 | 0.4807 | -0.8045 | 8.4677 |
| W5 | 1.4962 | 1.5221 | 0.3065 | 0.1321 | 0.3739 | 1.5151 | 0.3835 | -1.1542 | 13.4765 |
| W6 | 1.2617 | 1.2579 | 0.3968 | 0.0002 | 0.5430 | 1.2575 | 0.4250 | 0.0426 | 4.6310 |
| W7 | 1.4565 | 1.4885 | 0.3142 | 0.2123 | 0.4187 | 1.4884 | 0.4024 | -1.0535 | 12.3006 |
| W8 | 1.4300 | 1.4332 | 0.3831 | 0.0078 | 0.4383 | 1.4283 | 0.4245 | -0.2558 | 6.6903 |
| W9 | 1.7190 | 1.7097 | 0.5261 | -0.0157 | 0.4246 | 1.7041 | 0.5448 | -0.1810 | 3.2575 |
| W10 | 1.7668 | 1.7609 | 0.2626 | -0.0444 | 0.2849 | 1.7518 | 0.3489 | -1.4224 | 16.7051 |
| W11 | 1.2387 | 1.2737 | 0.3047 | 0.1988 | 0.4467 | 1.2772 | 0.3701 | 0.0679 | 10.2750 |
| W12 | 1.0282 | 1.0328 | 0.3920 | 0.0025 | 0.5772 | 1.0305 | 0.4501 | 0.3943 | 7.5239 |
| W13 | 1.2824 | 1.2665 | 0.3667 | -0.1351 | 0.5276 | 1.2565 | 0.4162 | -0.3605 | 7.5968 |
| W14 | 1.4070 | 1.4391 | 0.3773 | 0.1662 | 0.4476 | 1.4534 | 0.4379 | 0.7370 | 6.7789 |
| W20 | 0.2108 | 0.1639 | 0.5188 | -0.1429 | 0.9577 | 0.1817 | 0.5669 | 0.6927 | 6.1046 |
| W21 | 0.5619 | 0.5129 | 0.3699 | -0.1865 | 0.7346 | 0.5160 | 0.4195 | 0.6256 | 8.3426 |
| W22 | 1.1627 | 1.1413 | 0.2371 | -0.1173 | 0.3947 | 1.1429 | 0.3072 | -0.5477 | 11.5244 |
| W23 | 1.6082 | 1.7412 | 0.6185 | 0.2945 | 0.4739 | 1.7317 | 0.6469 | 0.2337 | 3.9977 |
| W24 | 1.1248 | 1.1409 | 0.2906 | 0.1124 | 0.4545 | 1.1488 | 0.3560 | 0.4065 | 10.1915 |
| W25 | 1.3258 | 1.3487 | 0.3118 | 0.1298 | 0.4146 | 1.3478 | 0.3584 | -0.3688 | 10.2952 |
| W26 | 1.4172 | 1.3942 | 0.3437 | -0.1170 | 0.4434 | 1.3854 | 0.3902 | -0.5995 | 6.5968 |
| W27 | 1.2098 | 1.3228 | 0.5263 | 0.3270 | 0.5816 | 1.3230 | 0.5542 | 0.5476 | 4.0529 |
| W28 | 0.5939 | 0.6508 | 0.5882 | 0.1636 | 0.9887 | 0.6632 | 0.5989 | 0.6473 | 3.6271 |
| W29 | 1.0942 | 1.0746 | 0.5587 | -0.0430 | 0.6597 | 1.0731 | 0.5881 | -0.0643 | 3.7902 |
| W30 | 1.2913 | 1.2979 | 0.2504 | 0.0584 | 0.3614 | 1.2978 | 0.2968 | -0.4514 | 11.6451 |
| W31 | 1.0423 | 1.0652 | 0.3230 | 0.1433 | 0.4937 | 1.0772 | 0.3980 | 0.9386 | 9.4694 |

Table 8b. SEDIMENT SURVEY DATA
 GRAIN SIZE STATISTICS
 WESTMORELAND COUNTY
 BACKSHORE

| STATION | G_MEDIAN | G_MEAN | G_STDEV | G_SKEWN | G_KURTO | M_MEAN | M_STDEV | M_SKEW | M_KURT |
|---------|----------|--------|---------|---------|---------|--------|---------|---------|---------|
| W32 | 1.3522 | 1.3800 | 0.3648 | 0.1694 | 0.4784 | 1.3978 | 0.4508 | 0.5729 | 8.7806 |
| W33 | 1.2561 | 1.3679 | 0.6138 | 0.2560 | 0.5804 | 1.3595 | 0.6290 | 0.2939 | 3.6052 |
| W34 | 1.5645 | 1.5749 | 0.2860 | 0.0803 | 0.3423 | 1.5811 | 0.3798 | -0.6618 | 15.8557 |
| W35 | 1.3886 | 1.4080 | 0.3041 | 0.0699 | 0.4036 | 1.3971 | 0.3877 | -0.4322 | 10.7078 |
| W36 | 1.5458 | 1.5658 | 0.4247 | 0.0043 | 0.4029 | 1.5463 | 0.4606 | -0.9795 | 6.9221 |
| W37 | 1.1936 | 1.1806 | 0.2703 | -0.0738 | 0.4098 | 1.1827 | 0.3385 | 0.2626 | 11.4017 |
| W38 | 1.4477 | 1.4938 | 0.3792 | 0.1516 | 0.4177 | 1.4819 | 0.4331 | -0.4433 | 7.4816 |
| W39 | 1.1869 | 1.1909 | 0.3067 | 0.0136 | 0.4608 | 1.1827 | 0.3663 | -0.2692 | 7.4560 |
| W40 | 0.9129 | 0.5638 | 0.8020 | -0.5129 | 1.0680 | 0.7126 | 0.7864 | -0.3802 | 3.9782 |
| W41 | 0.7160 | 0.6950 | 0.4719 | -0.0218 | 0.7258 | 0.7284 | 0.5630 | 0.9414 | 6.3832 |
| W42 | 0.9847 | 1.0109 | 0.5350 | 0.1669 | 0.9470 | 1.0419 | 0.6515 | 0.9418 | 7.1869 |
| W43 | 0.7533 | 0.7410 | 0.2674 | -0.0949 | 0.5658 | 0.7757 | 0.4841 | 2.8929 | 20.8250 |
| W44 | 0.3787 | 0.4246 | 0.7430 | 0.2452 | 1.2622 | 0.5221 | 0.7957 | 1.2604 | 5.0119 |
| W45 | 0.3804 | 0.2915 | 0.7820 | -0.0252 | 1.3139 | 0.4125 | 0.8874 | 1.2544 | 5.8048 |
| W46 | 0.8115 | 0.8025 | 0.3241 | -0.0088 | 0.6709 | 0.8274 | 0.4391 | 2.2874 | 16.7164 |
| W47 | 0.0819 | 0.1204 | 0.5364 | 0.0664 | 1.4355 | 0.1291 | 0.6032 | 0.9193 | 5.7032 |
| W48 | 1.2632 | 1.2278 | 0.4616 | -0.1490 | 0.6373 | 1.2231 | 0.5209 | -0.3687 | 5.3541 |
| W49 | 0.7643 | 0.7427 | 0.6679 | -0.0283 | 0.9918 | 0.7460 | 0.7161 | 0.2603 | 3.8745 |
| W50 | 1.0521 | 1.0402 | 0.1981 | -0.1000 | 0.3663 | 1.0455 | 0.2935 | 1.4328 | 18.4176 |
| W51 | 1.1901 | 1.1868 | 0.3021 | -0.0487 | 0.4898 | 1.1917 | 0.4261 | 0.8899 | 13.8917 |
| W52 | 1.2097 | 1.2090 | 0.2842 | -0.0065 | 0.4212 | 1.2091 | 0.3410 | -0.1026 | 9.2859 |
| W59 | 1.1178 | 1.1394 | 0.3103 | 0.1119 | 0.4805 | 1.1531 | 0.4106 | 1.1714 | 11.4415 |
| W60 | 1.3899 | 1.4058 | 0.2804 | 0.0983 | 0.3661 | 1.4018 | 0.3805 | -0.5874 | 17.1334 |
| W101 | 1.0745 | 1.0336 | 0.4538 | -0.1528 | 0.5875 | 1.0321 | 0.4894 | -0.0797 | 4.7064 |
| W102 | 1.4313 | 1.4022 | 0.3831 | -0.1498 | 0.4602 | 1.3877 | 0.4538 | -0.6843 | 7.1855 |
| W104 | 0.7769 | 0.7432 | 0.6562 | -0.0608 | 0.7393 | 0.7583 | 0.6415 | 0.1388 | 2.6032 |

TABLE 9. WESTMORELAND COUNTY
FORESHORE SLOPE INVENTORY

| Station ID | Slope (degrees) |
|------------|-----------------|
| W1 | 21.5 |
| W2 | 11.0 |
| W3 | 9.5 |
| W4 | 6.0 |
| W5 | 8.5 |
| W6 | 9.5 |
| W7 | 7.0 |
| W8 | 8.0 |
| W9 | 8.0 |
| W10 | 10.0 |
| W11 | 6.0 |
| W12 | 6.0 |
| W13 | 5.0 |
| W14 | 5.0 |
| W20 | 7.0 |
| W21 | 6.0 |
| W22 | 10.0 |
| W23 | 7.5 |
| W24 | 6.5 |
| W25 | 4.0 |
| W26 | 6.5 |
| W27 | 7.0 |
| W28 | 11.0 |
| W29 | 3.0 |
| W30 | 7.5 |
| W31 | 8.0 |
| W32 | 7.0 |
| W33 | 8.5 |
| W34 | 10.0 |
| W35 | 7.5 |
| W36 | 6.0 |
| W37 | 9.5 |
| W38 | 10.5 |
| W39 | 9.5 |
| W40 | 7.5 |
| W41 | 8.0 |
| W42 | 9.5 |
| W43 | 9.5 |
| W44 | 10.0 |
| W45 | 9.5 |
| W46 | 9.0 |
| W47 | 9.5 |
| W48 | 6.5 |

WESTMORELAND COUNTY
FORESHORE SLOPE INVENTORY

| Station ID | Slope (degrees) |
|------------|-----------------|
|------------|-----------------|

| | |
|------|-----|
| W49 | 8.5 |
| W50 | 6.5 |
| W51 | 6.5 |
| W52 | 6.5 |
| W101 | 7.5 |
| W102 | 6.0 |
| W103 | 8.2 |
| W104 | 6.5 |

Table 10a. SEDIMENT SURVEY DATA
 GRAIN SIZE PERCENTAGES
 LANCASTER COUNTY
 FORESHORE

| STATION | GRAVEL% | SAND% | SILT% | CLAY% |
|---------|---------|-------|-------|-------|
| L1 | 18.0 | 81.5 | 0.5 | 0.0 |
| L2 | 2.8 | 96.8 | 0.4 | 0.0 |
| L3 | 4.2 | 95.4 | 0.4 | 0.0 |
| L4 | 6.1 | 93.3 | 0.6 | 0.0 |
| L5 | 0.9 | 98.6 | 0.5 | 0.0 |
| L6 | 5.8 | 93.8 | 0.4 | 0.0 |
| L7 | 1.9 | 97.6 | 0.5 | 0.0 |
| L8 | 2.2 | 97.3 | 0.5 | 0.0 |
| L9 | 10.7 | 89.0 | 0.3 | 0.0 |
| L10 | 10.5 | 89.4 | 0.1 | 0.0 |
| L11 | 1.0 | 98.4 | 0.6 | 0.0 |
| L12 | 4.2 | 95.6 | 0.2 | 0.0 |
| L13 | 0.0 | 99.7 | 0.3 | 0.0 |
| L14 | 0.2 | 99.3 | 0.5 | 0.0 |
| L15 | 13.0 | 86.4 | 0.6 | 0.0 |
| L16 | 0.9 | 98.6 | 0.5 | 0.0 |
| L17 | 0.0 | 99.5 | 0.5 | 0.0 |
| L18 | 0.3 | 99.7 | 0.0 | 0.0 |
| L19 | 1.3 | 98.2 | 0.5 | 0.0 |
| L20 | 0.1 | 99.2 | 0.7 | 0.0 |
| L21 | 0.0 | 99.6 | 0.4 | 0.0 |
| L22 | 4.3 | 95.1 | 0.6 | 0.0 |
| L23 | 2.0 | 97.7 | 0.3 | 0.0 |
| L24 | 18.8 | 80.7 | 0.5 | 0.0 |
| L25 | 12.0 | 87.5 | 0.5 | 0.0 |
| L26 | 8.5 | 90.9 | 0.6 | 0.0 |
| L27 | 43.1 | 55.8 | 1.1 | 0.0 |
| L28 | 22.8 | 75.9 | 1.3 | 0.0 |
| L29 | 3.3 | 94.8 | 1.9 | 0.0 |
| L30 | 1.6 | 96.8 | 1.6 | 0.0 |

Table 10b. SEDIMENT SURVEY DATA
 GRAIN SIZE STATISTICS
 LANCASTER COUNTY
 FORESHORE

| STATION | G_MEDIAN | G_MEAN | G_STDEV | G_SKEWN | G_KURTO | M_MEAN | M_STDEV | M_SKEW | M_KURT |
|---------|----------|---------|---------|---------|---------|--------|---------|---------|---------|
| L1 | 0.6063 | 0.5375 | 0.6267 | -0.1537 | 0.9126 | 0.5482 | 0.6446 | 0.1710 | 3.6003 |
| L2 | 0.3595 | 0.3617 | 0.4922 | -0.0332 | 0.9229 | 0.3830 | 0.5660 | 0.8954 | 6.7553 |
| L3 | 0.3053 | 0.3681 | 0.5618 | 0.1889 | 0.9031 | 0.4090 | 0.6090 | 0.9132 | 4.6828 |
| L4 | 0.2428 | 0.2763 | 0.5767 | 0.0704 | 1.1714 | 0.3015 | 0.6398 | 1.2573 | 7.4641 |
| L5 | 0.5837 | 0.5671 | 0.4522 | -0.0682 | 0.8580 | 0.5746 | 0.4867 | 0.5056 | 5.7361 |
| L6 | 0.1107 | 0.0832 | 0.5728 | -0.0215 | 1.1852 | 0.1182 | 0.6025 | 0.7982 | 5.1259 |
| L7 | 0.4477 | 0.4352 | 0.4377 | -0.0056 | 0.9141 | 0.4899 | 0.5803 | 2.0699 | 11.5242 |
| L8 | 0.6581 | 0.6322 | 0.3311 | -0.1357 | 0.7036 | 0.6394 | 0.3905 | 1.1328 | 11.4603 |
| L9 | -0.0601 | -0.0466 | 0.5203 | 0.1559 | 1.8150 | 0.0330 | 0.6812 | 2.5069 | 13.0513 |
| L10 | 0.0415 | -0.0020 | 0.4795 | -0.0852 | 1.5587 | 0.0615 | 0.6176 | 1.9689 | 11.2481 |
| L11 | 0.5762 | 0.5595 | 0.4274 | -0.0727 | 0.7836 | 0.5686 | 0.5030 | 0.9421 | 9.2625 |
| L12 | 0.0311 | 0.0323 | 0.5315 | 0.0927 | 1.5006 | 0.0944 | 0.6750 | 2.1360 | 10.6280 |
| L13 | 0.7193 | 0.6971 | 0.3034 | -0.0781 | 0.6996 | 0.7268 | 0.4279 | 2.0424 | 16.3847 |
| L14 | 0.7182 | 0.6699 | 0.5052 | -0.0629 | 0.8059 | 0.7069 | 0.5430 | 0.5105 | 4.5889 |
| L15 | 0.7358 | 0.6310 | 0.8483 | -0.1352 | 1.0633 | 0.6379 | 0.8786 | 0.0855 | 3.0303 |
| L16 | 1.2831 | 1.2950 | 0.5467 | 0.0347 | 0.5902 | 1.2885 | 0.5875 | -0.1935 | 4.7020 |
| L17 | 1.3090 | 1.3033 | 0.4294 | -0.0501 | 0.5360 | 1.2854 | 0.4709 | -0.7872 | 6.3947 |
| L18 | 0.8481 | 0.8320 | 0.3448 | -0.1079 | 0.6182 | 0.8260 | 0.4251 | 0.1699 | 8.1669 |
| L19 | 0.9623 | 0.9815 | 0.7069 | -0.0121 | 0.8021 | 0.9512 | 0.7351 | -0.0714 | 3.6395 |
| L20 | 1.3714 | 1.3956 | 0.5259 | 0.0216 | 0.6168 | 1.3713 | 0.5496 | -0.3802 | 4.5635 |
| L21 | 0.9147 | 0.9318 | 0.5358 | 0.0877 | 0.7266 | 0.9471 | 0.5805 | 0.7600 | 5.4911 |
| L22 | 0.8414 | 0.7675 | 0.6904 | -0.1403 | 0.7718 | 0.7898 | 0.7097 | 0.3125 | 3.6459 |
| L23 | 0.8648 | 0.7851 | 0.5686 | -0.1616 | 0.6652 | 0.8158 | 0.6008 | 0.3186 | 4.3191 |
| L24 | 0.4762 | 0.3916 | 0.5909 | -0.1587 | 0.9540 | 0.4427 | 0.6424 | 0.8373 | 5.9245 |
| L25 | 0.3137 | 0.2848 | 0.6006 | -0.0474 | 0.9910 | 0.3035 | 0.6323 | 0.6504 | 4.9139 |
| L26 | 0.3821 | 0.3154 | 0.6358 | -0.0947 | 1.2941 | 0.3726 | 0.6733 | 0.5785 | 4.7405 |

Table 10b. SEDIMENT SURVEY DATA
GRAIN SIZE STATISTICS
LANCASTER COUNTY
FORESHORE

| STATION | G_MEDIAN | G_MEAN | G_STDEV | G_SKEWN | G_KURTO | M_MEAN | M_STDEV | M_SKEW | M_KURT |
|---------|----------|--------|---------|---------|---------|--------|---------|---------|--------|
| L27 | -0.0618 | 0.2284 | 0.9162 | 0.5064 | 1.2769 | 0.3107 | 0.9897 | 1.2755 | 4.4423 |
| L28 | 0.1475 | 0.2938 | 0.8472 | 0.2354 | 0.9295 | 0.2868 | 0.8249 | 0.5051 | 2.2920 |
| L29 | 1.1688 | 0.8795 | 0.7780 | -0.4954 | 0.8346 | 0.9462 | 0.8115 | -0.3150 | 3.5330 |
| L30 | 0.6277 | 0.6191 | 0.6451 | -0.0311 | 1.0777 | 0.6107 | 0.6511 | 0.1789 | 3.4904 |

Table 11a. SEDIMENT SURVEY DATA
 GRAIN SIZE PERCENTAGES
 LANCASTER COUNTY
 BACKSHORE

| STATION | GRAVEL% | SAND% | SILT% | CLAY% |
|---------|---------|-------|-------|-------|
| L1 | 8.9 | 90.8 | 0.3 | 0.0 |
| L2 | 0.9 | 98.6 | 0.5 | 0.0 |
| L3 | 0.1 | 99.2 | 0.7 | 0.0 |
| L4 | 0.0 | 99.5 | 0.5 | 0.0 |
| L5 | 0.0 | 99.5 | 0.5 | 0.0 |
| L6 | 0.0 | 99.8 | 0.2 | 0.0 |
| L7 | 0.0 | 99.7 | 0.3 | 0.0 |
| L8 | 0.3 | 99.3 | 0.4 | 0.0 |
| L9 | 2.1 | 97.6 | 0.3 | 0.0 |
| L10 | 0.0 | 99.7 | 0.3 | 0.0 |
| L11 | 0.0 | 99.8 | 0.2 | 0.0 |
| L12 | 0.0 | 99.9 | 0.1 | 0.0 |
| L13 | 0.0 | 99.7 | 0.3 | 0.0 |
| L14 | 0.0 | 99.3 | 0.7 | 0.0 |
| L15 | 0.1 | 99.5 | 0.4 | 0.0 |
| L16 | 6.9 | 92.0 | 1.1 | 0.0 |
| L17 | 0.0 | 99.4 | 0.6 | 0.0 |
| L18 | 11.4 | 88.5 | 0.1 | 0.0 |
| L19 | 0.0 | 97.2 | 2.8 | 0.0 |
| L20 | 0.0 | 98.7 | 1.3 | 0.0 |
| L21 | 0.0 | 99.8 | 0.2 | 0.0 |
| L22 | 0.2 | 99.6 | 0.2 | 0.0 |
| L23 | 0.0 | 99.8 | 0.2 | 0.0 |
| L24 | 0.0 | 99.7 | 0.3 | 0.0 |
| L25 | 4.2 | 95.5 | 0.3 | 0.0 |
| L26 | 0.0 | 99.2 | 0.8 | 0.0 |
| L27 | 0.0 | 98.2 | 1.8 | 0.0 |
| L28 | 0.0 | 98.9 | 1.1 | 0.0 |
| L29 | 0.0 | 98.5 | 1.5 | 0.0 |
| L30 | 1.1 | 97.7 | 1.2 | 0.0 |

Table 11b. SEDIMENT SURVEY DATA
 GRAIN SIZE STATISTICS
 LANCASTER COUNTY
 BACKSHORE

| STATION | G_MEDIAN | G_MEAN | G_STDEV | G_SKEWN | G_KURTO | M_MEAN | M_STDEV | M_SKEW | M_KURT |
|---------|----------|--------|---------|---------|---------|--------|---------|---------|---------|
| L1 | 1.1309 | 1.0881 | 0.4841 | -0.1915 | 0.7077 | 1.0697 | 0.5470 | -0.5605 | 5.4967 |
| L2 | 1.0419 | 1.0897 | 0.5327 | 0.1195 | 0.7522 | 1.0965 | 0.6297 | 0.5406 | 6.2936 |
| L3 | 0.9161 | 0.9212 | 0.4910 | 0.0665 | 0.6876 | 0.9474 | 0.5301 | 0.7835 | 5.8942 |
| L4 | 1.1177 | 1.1334 | 0.3779 | 0.0911 | 0.5368 | 1.1528 | 0.4781 | 0.8470 | 8.9261 |
| L5 | 0.9465 | 0.9342 | 0.4336 | -0.0724 | 0.6498 | 0.9515 | 0.5203 | 1.0034 | 9.2268 |
| L6 | 0.7166 | 0.7346 | 0.4407 | 0.1139 | 0.7484 | 0.7581 | 0.4893 | 0.7451 | 5.6697 |
| L7 | 0.7981 | 0.7695 | 0.3400 | -0.1258 | 0.6156 | 0.7758 | 0.4359 | 1.3760 | 15.6959 |
| L8 | 0.9163 | 0.9185 | 0.3365 | -0.0394 | 0.6019 | 0.9405 | 0.4854 | 2.1944 | 14.1352 |
| L9 | 0.9943 | 0.9529 | 0.4444 | -0.1792 | 0.6888 | 0.9580 | 0.5269 | 0.6387 | 8.0728 |
| L10 | 1.1945 | 1.2067 | 0.3299 | -0.0098 | 0.5170 | 1.2031 | 0.4071 | 0.4105 | 8.2218 |
| L11 | 1.2917 | 1.2863 | 0.2324 | -0.0291 | 0.3590 | 1.3079 | 0.4289 | 1.3501 | 18.7101 |
| L12 | 0.9288 | 0.9033 | 0.3478 | -0.1492 | 0.6092 | 0.9015 | 0.4215 | -0.1678 | 8.1517 |
| L13 | 1.1653 | 1.1653 | 0.3270 | -0.0157 | 0.4827 | 1.1596 | 0.3846 | -0.2275 | 8.8059 |
| L14 | 0.9867 | 1.0184 | 0.6216 | 0.0645 | 0.8235 | 1.0149 | 0.6331 | 0.1845 | 3.6684 |
| L15 | 1.5919 | 1.5986 | 0.3997 | 0.0160 | 0.4513 | 1.6051 | 0.4925 | 0.4645 | 6.6641 |
| L16 | 1.2673 | 1.2782 | 0.9459 | -0.0360 | 0.6198 | 1.2706 | 0.9443 | -0.1318 | 2.2269 |
| L17 | 1.5378 | 1.5333 | 0.4255 | -0.0551 | 0.4528 | 1.5215 | 0.4830 | -0.7277 | 7.5365 |
| L18 | 0.7997 | 0.7149 | 0.5260 | -0.3242 | 0.9330 | 0.6997 | 0.5651 | -0.5628 | 4.5888 |
| L19 | 1.9664 | 1.8264 | 0.6739 | -0.3396 | 0.5544 | 1.8094 | 0.6984 | -0.8632 | 3.7219 |
| L20 | 1.4956 | 1.5294 | 0.3993 | 0.1289 | 0.4490 | 1.5295 | 0.4674 | -0.0275 | 9.0580 |
| L21 | 1.5805 | 1.5814 | 0.2800 | 0.0007 | 0.3510 | 1.5812 | 0.3809 | -0.0105 | 14.5239 |
| L22 | 1.4014 | 1.3788 | 0.3263 | -0.1296 | 0.4524 | 1.3804 | 0.4652 | 0.2481 | 12.2284 |
| L23 | 1.2897 | 1.2868 | 0.3336 | -0.0303 | 0.4187 | 1.2942 | 0.3967 | 0.8021 | 8.5445 |
| L24 | 1.1686 | 1.1788 | 0.4272 | 0.0871 | 0.6303 | 1.2060 | 0.5159 | 1.1486 | 8.3017 |
| L25 | 0.5912 | 0.5588 | 0.5127 | -0.1046 | 0.9384 | 0.5553 | 0.5430 | -0.1277 | 4.1520 |
| L26 | 1.2327 | 1.2584 | 0.3993 | 0.1230 | 0.4885 | 1.2708 | 0.4566 | 0.6463 | 7.4611 |

Table 11b. SEDIMENT SURVEY DATA
GRAIN SIZE STATISTICS
LANCASTER COUNTY
BACKSHORE

| STATION | G_MEDIAN | G_MEAN | G_STDEV | G_SKEWN | G_KURTO | M_MEAN | M_STDEV | M_SKEW | M_KURT |
|---------|----------|--------|---------|---------|---------|--------|---------|---------|--------|
| L27 | 1.5111 | 1.5178 | 0.2894 | 0.0036 | 0.3519 | 1.5105 | 0.3457 | -0.2752 | 8.9087 |
| L28 | 1.5061 | 1.4669 | 0.3774 | -0.1654 | 0.4185 | 1.4612 | 0.4299 | -0.4299 | 6.4050 |
| L29 | 1.0428 | 1.0329 | 0.4452 | -0.0888 | 0.6106 | 1.0338 | 0.5276 | 0.0721 | 7.3261 |
| L30 | 0.7540 | 0.7103 | 0.7646 | -0.0507 | 0.6824 | 0.7139 | 0.7609 | 0.1068 | 2.0798 |

**TABLE 12. LANCASTER COUNTY
FORESHORE SLOPE INVENTORY**

| Station ID | Slope (degrees) |
|-------------------|------------------------|
| L1 | 6.5 |
| L2 | 6.5 |
| L3 | 9.0 |
| L4 | 9.5 |
| L5 | 10.0 |
| L6 | 7.0 |
| L7 | 6.0 |
| L8 | 5.0 |
| L9 | 5.5 |
| L10 | 5.5 |
| L11 | 10.0 |
| L12 | 10.0 |
| L13 | 10.0 |
| L14 | 6.0 |
| L15 | 10.5 |
| L16 | 8.5 |
| L17 | 6.0 |
| L18 | 6.0 |
| L19 | 6.5 |
| L20 | 7.0 |
| L21 | 8.5 |
| L22 | 10.0 |
| L23 | 5.5 |
| L24 | 8.5 |
| L25 | 9.5 |
| L26 | 11.0 |
| L27 | 11.5 |
| L28 | 8.5 |
| L29 | 9.0 |
| L30 | 7.0 |

Table 13a. SEDIMENT SURVEY DATA
GRAIN SIZE PERCENTAGES
RICHMOND COUNTY
FORESHORE

| STATION | GRAVEL% | SAND% | SILT% | CLAY% |
|---------|---------|-------|-------|-------|
| R1 | 1.0 | 96.9 | 2.1 | 0.0 |
| R2 | 12.0 | 86.7 | 1.3 | 0.0 |
| R3 | 10.7 | 87.6 | 1.7 | 0.0 |
| R4 | 7.1 | 91.7 | 1.2 | 0.0 |
| R5 | 0.5 | 97.4 | 2.1 | 0.0 |
| R6 | 1.1 | 96.7 | 2.2 | 0.0 |
| R7 | 71.3 | 27.1 | 1.6 | 0.0 |
| R8 | 2.1 | 96.3 | 1.6 | 0.0 |
| R9 | 13.8 | 70.9 | 15.3 | 0.0 |
| R10 | 33.5 | 64.7 | 1.8 | 0.0 |

Tables 13b. SEDIMENT SURVEY DATA
 GRAIN SIZE STATISTICS
 RICHMOND COUNTY
 FORESHORE

| STATION | G_MEDIAN | G_MEAN | G_STDEV | G_SKEWN | G_KURTO | M_MEAN | M_STDEV | M_SKEW | M_KURT |
|---------|----------|--------|---------|---------|---------|--------|---------|---------|--------|
| R1 | 1.1937 | 1.1118 | 0.5656 | -0.2285 | 0.6404 | 1.1015 | 0.5847 | -0.3899 | 3.6972 |
| R2 | 0.2197 | 0.2937 | 0.6901 | 0.1525 | 1.1561 | 0.3040 | 0.7124 | 0.9215 | 4.8681 |
| R3 | 0.5103 | 0.4400 | 0.8436 | -0.0944 | 0.8244 | 0.4622 | 0.8291 | 0.0522 | 2.2828 |
| R4 | 0.6102 | 0.6302 | 0.7114 | 0.0608 | 0.8096 | 0.6331 | 0.7322 | 0.2947 | 3.0351 |
| R5 | 1.0264 | 0.9727 | 0.5507 | -0.1441 | 0.6227 | 0.9790 | 0.5910 | 0.0507 | 4.9251 |
| R6 | 1.3183 | 1.2583 | 0.4028 | -0.2555 | 0.4951 | 1.2450 | 0.4654 | -0.9582 | 7.2409 |
| R7 | 0.1606 | 0.3489 | 0.9850 | -0.2555 | 0.8803 | 0.4096 | 1.0285 | 0.6928 | 3.0316 |
| R8 | 1.0494 | 1.0608 | 0.5423 | -0.0095 | 0.6829 | 1.0467 | 0.5442 | -0.2390 | 3.3642 |
| R9 | 1.8220 | 1.8496 | 1.0538 | -0.0569 | 0.6506 | 1.7988 | 1.0048 | -0.3062 | 2.4993 |
| R10 | 1.0087 | 0.8560 | 0.9121 | -0.1958 | 0.7226 | 0.8662 | 0.9251 | 0.0135 | 2.2895 |

Table 14a. SEDIMENT SURVEY DATA
GRAIN SIZE PERCENTAGES
RICHMOND COUNTY
BACKSHORE

| STATION | GRAVEL% | SAND% | SILT% | CLAY% |
|---------|---------|-------|-------|-------|
| R1 | 2.3 | 96.3 | 1.4 | 0.0 |
| R2 | 0.1 | 97.2 | 2.7 | 0.0 |
| R3 | 9.5 | 88.9 | 1.6 | 0.0 |
| R4 | 0.0 | 98.2 | 1.8 | 0.0 |
| R5 | 0.0 | 97.5 | 2.5 | 0.0 |
| R7 | 27.3 | 70.2 | 2.5 | 0.0 |
| R8 | 0.0 | 97.7 | 2.3 | 0.0 |
| R9 | 4.2 | 90.7 | 5.1 | 0.0 |
| R10 | 16.3 | 82.0 | 1.7 | 0.0 |

Table 14b. SEDIMENT SURVEY DATA
 GRAIN SIZE STATISTICS
 RICHMOND COUNTY
 BACKSHORE

| STATION | G_MEDIAN | G_MEAN | G_STDEV | G_SKEWN | G_KURTO | M_MEAN | M_STDEV | M_SKEW | M_KURT |
|---------|----------|--------|---------|---------|---------|--------|---------|---------|--------|
| R1 | 0.5673 | 0.5827 | 0.7318 | 0.0259 | 0.8047 | 0.5893 | 0.7394 | 0.2779 | 2.8913 |
| R2 | 1.1960 | 1.1418 | 0.4410 | -0.2932 | 0.6463 | 1.1194 | 0.5007 | -0.4588 | 6.8571 |
| R3 | 0.4694 | 0.4852 | 0.6664 | 0.0270 | 0.9984 | 0.4983 | 0.7437 | 0.9879 | 5.6149 |
| R4 | 1.5206 | 1.5034 | 0.3286 | -0.1686 | 0.4213 | 1.4747 | 0.3801 | -1.0774 | 6.4217 |
| R5 | 1.2862 | 1.2488 | 0.4159 | -0.1267 | 0.4759 | 1.2561 | 0.4764 | 0.2513 | 7.0692 |
| R7 | 0.9289 | 0.7378 | 0.8932 | -0.2618 | 0.7614 | 0.7882 | 0.9010 | -0.0141 | 2.5827 |
| R8 | 1.5321 | 1.5198 | 0.3381 | -0.0714 | 0.3936 | 1.5100 | 0.3945 | -1.0048 | 8.6754 |
| R9 | 1.3614 | 1.2405 | 0.6410 | -0.3751 | 0.7612 | 1.2305 | 0.7239 | -0.4698 | 5.2671 |
| R10 | 1.2059 | 0.9641 | 0.7864 | -0.4089 | 0.7522 | 1.0173 | 0.8495 | 0.0007 | 3.7944 |

TABLE 15. RICHMOND COUNTY
FORESHORE SLOPE INVENTORY

| Station ID | Slope (degrees) |
|------------|-----------------|
| R1 | 12.5 |
| R2 | 9.5 |
| R3 | 9.5 |
| R4 | 5.5 |
| R5 | 6.5 |
| R6 | 11.0 |
| R7 | 8.3 |
| R8 | 10.0 |
| R9 | 4.5 |
| R10 | 8.0 |
| R11 | 9.0 |
| R12 | 14.0 |
| R13 | 19.0 |
| R14 | 14.0 |
| R15 | 15.0 |
| R16 | 14.0 |
| R17 | 13.0 |
| R18 | 15.0 |
| R19 | 5.0 |
| R20 | 11.0 |
| R21 | 15.0 |
| R22 | 15.0 |
| R23 | 16.0 |
| R24 | 12.0 |
| R25 | 15.0 |
| R26 | 21.0 |
| R27 | 15.0 |
| R28 | 14.0 |
| R29 | 18.0 |
| R30 | 18.0 |
| R31 | 15.0 |
| R32 | 15.0 |
| R33 | 10.0 |
| R34 | 15.0 |

**TABLE 16. NORTHUMBERLAND COUNTY
FORESHORE SLOPE INVENTORY**

| Station ID | Slope (degrees) |
|------------|-----------------|
| N1 | 15.0 |
| N2 | 14.0 |
| N3 | 11.0 |
| N4 | 13.0 |
| N5 | 5.0 |
| N6 | 13.0 |
| N7 | 10.0 |
| N8 | 10.0 |
| N9 | 5.0 |
| N10 | 17.0 |
| N11 | 12.0 |
| N12 | 12.0 |
| N13 | 15.0 |
| N14 | 16.0 |
| N15 | 15.0 |
| N16 | 11.0 |
| N17 | 19.0 |
| N18 | 15.0 |
| N19 | 20.0 |
| N20 | 14.0 |
| N21 | 10.0 |
| N22 | 14.0 |
| N23 | 10.0 |

CHAPTER XI. TIDAL MARSH INVENTORY COVERAGE

XI. TIDAL MARSH INVENTORY COVERAGE

The Tidal Marsh Inventory Coverage (TMI) is the digital record of the VIMS Tidal Marsh Inventories developed by the Wetlands Research Program at the Virginia Institute of Marine Science (VIMS). The original delineation of tidal marshes were obtained using aerial photographs, topographic maps, and ground-truthing methods. The tidal marsh boundaries, forming polygons, were digitized at a scale of 1:24,000 and coded by location (FIPS). The marsh polygons are then transposed onto the SHL, 1:24,000 shoreline coverage (ref. Chapter 2). Future updates to the GIS Inventory will code marshes (e.g. polygons) by an existing set of criteria which will identify marsh polygons on the basis of species and habitat. Following is a complete folio of existing TMI coverages, represented at a scale of 1:68,000, and documentation pertaining to these coverages.

GEOGRAPHIC DATA SET DESCRIPTION

VIMS GIS Lab Prefix TMIData Layer Name VIMS Tidal Marsh Inventory (VIMS Wetlands Inventory)

Description Inventory of tidal wetlands in Virginia, by Wetlands Dept.
of the Virginia Institute of Marine Science, as mandated by Sec. 62.1-13.4
of the Virginia Wetlands Act of 1972 (Code of Va., Title 62.1).

Year(s) Collected Various, 1974 - presentBase Maps used for Digitizing MYLAR USGS TOPO MAPSDigitizing Scale 1:24000 Map Projection UTM Zone 18

Geographic Extent Inventories complete for most of Va. coastal counties,
selected portions of the coastal zone have been digitized.

How Collected (Describe):

Tidal marsh data was collected by groundtruthing the tidal waters of
Virginia. Inventory reports were then published and wetland polygons were
transferred to mylar topos for digitizing.

Actual/Intended Use or Purpose:

The TMI coverages were generated with the intended purpose of creating
RPA and RMA planning maps, for evaluating salinity induced changes in
the upper Pamunkey River, and monitoring changes to wetland resources.

VA TIDAL RIVERS INVENTORY

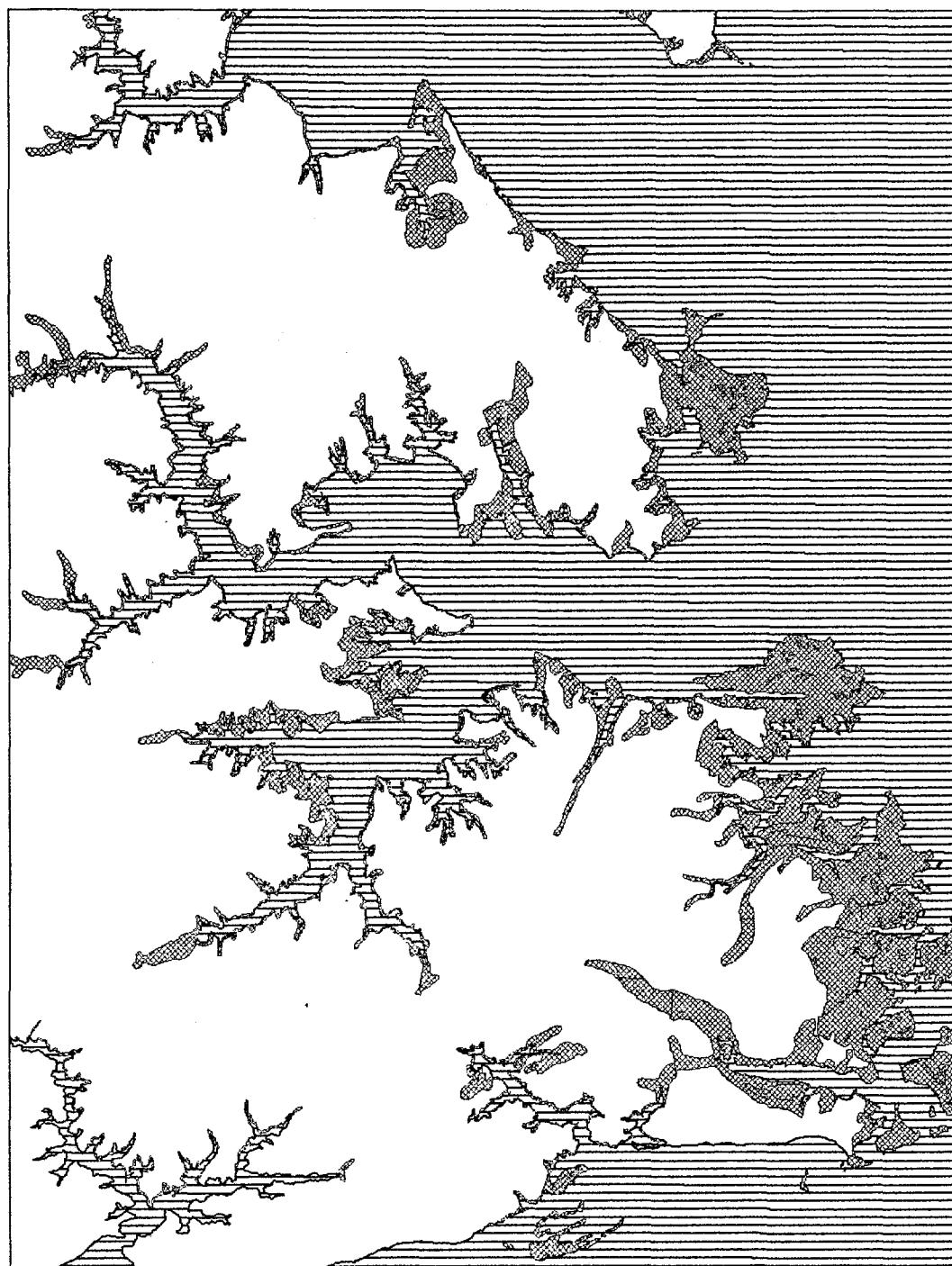
AVERAGE TIME AND DISC SPACE USED*

TIDAL MARSH INVENTORY

| MAP
NUMBER | TIME | DISC
SPACE |
|---------------|-------|---------------|
| TMI5307 | 18.0 | 296960 |
| TMI5407 | 18.0 | 342016 |
| TMI5413 | 5.25 | 178176 |
| TMI5414 | 21.0 | 251904 |
| TMI5415 | 21.0 | 382976 |
| TMI5506 | 5.5 | 90112 |
| TMI5507 | 24.0 | 497664 |
| TMI5512 | 13.0 | 264192 |
| TMI5513 | 25.0 | 391168 |
| TMI5514 | 13.0 | 227320 |
| TMI5515 | 2.0 | 73728 |
| TMI5607 | 19.0 | 415744 |
| TMI5611 | 8.0 | 124928 |
| TMI5612 | 35.0 | 526336 |
| TMI5613 | 10.0 | 116736 |
| TMI5711 | 33.0 | 444416 |
| TMI5712 | 15.0 | 184320 |
| TMI5713 | 19.0 | 423936 |
| TMI5714 | 11.0 | 240468 |
| TMI5807 | 17.25 | 446464 |
| TMI5808 | 5.0 | 81920 |
| TMI5809 | 15.0 | 307200 |
| TMI5810 | 20.0 | 622592 |
| TMI5811 | 16.0 | 229376 |
| TMI5812 | 7.5 | 178176 |
| TMI5813 | 19.0 | 356352 |
| TMI5814 | 1.25 | 69632 |
| TMI5907 | 55.0 | 999424 |
| TMI5909 | 26.5 | 569344 |
| TMI5910 | 14.0 | 315392 |
| TMI5911 | 13.0 | 196608 |
| TMI5912 | 17.5 | 587776 |
| TMI5913 | 2.5 | 88064 |
| TMI6007 | 17.25 | 307200 |
| TMI6010 | 17.0 | 491520 |
| TMI6011 | 36.0 | 697568 |
| TMI6012 | 23.5 | 512000 |

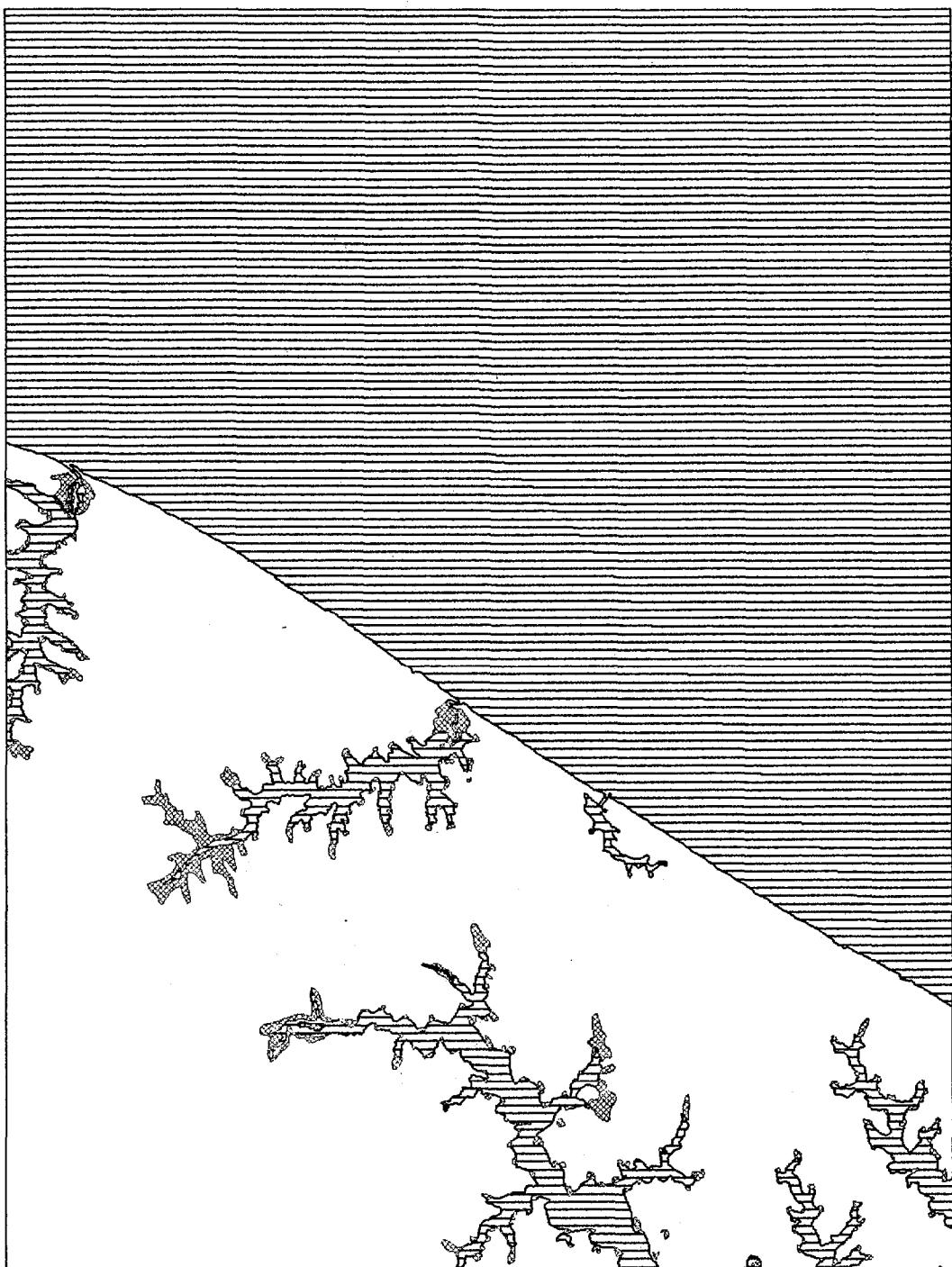
| | | | | |
|---------|--|-------|--|--------|
| AVERAGE | | 17.25 | | 338641 |
|---------|--|-------|--|--------|

*TIME IN HOURS, DISC SPACE IN BYTES



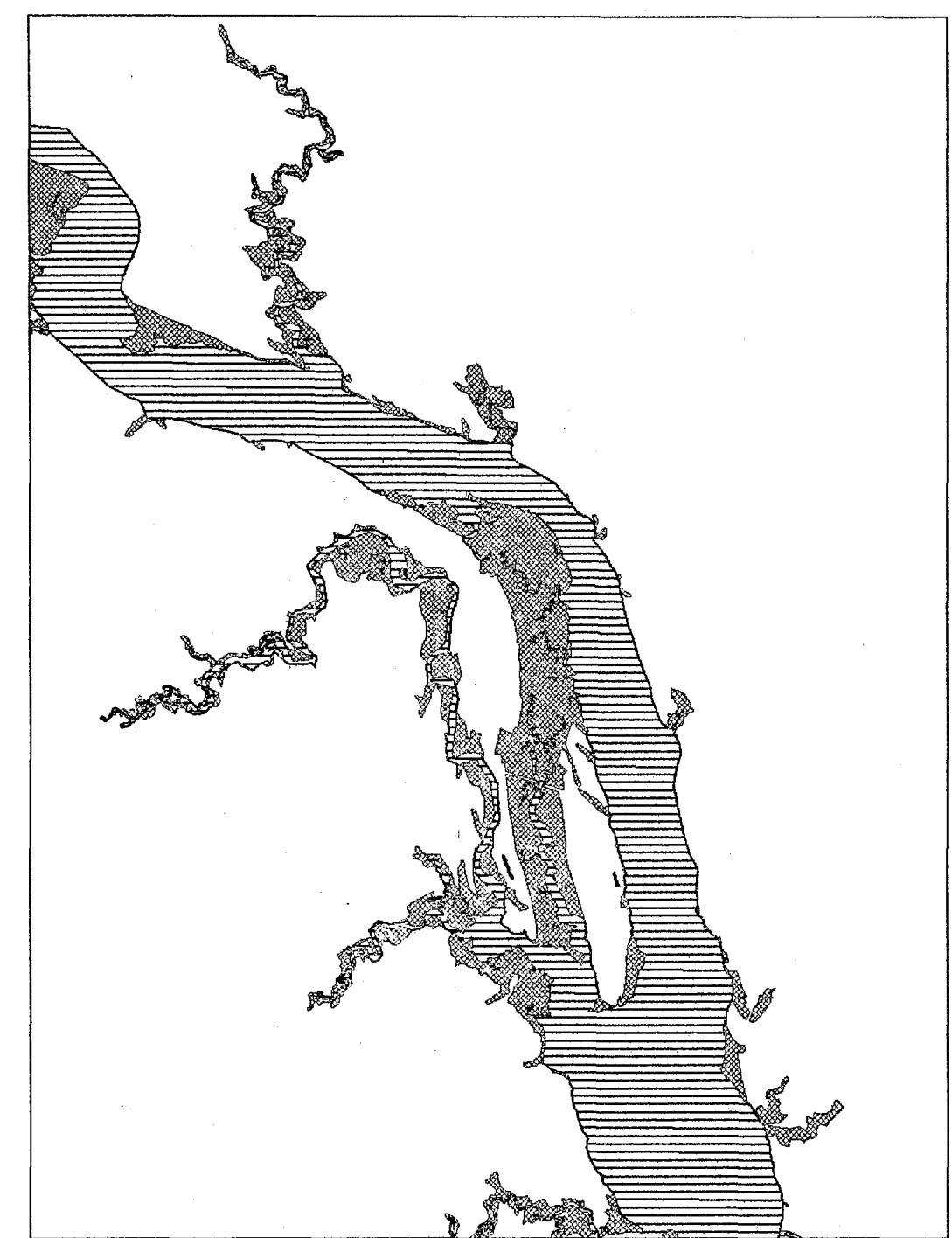
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VIMS TIDAL MARSH INVENTORY
ACHILLES
GLOUCESTER COUNTY

TMI5907
■ WETLANDS
— WATER



VIMS COASTAL INVENTORIES
VIMS TIDAL MARSH INVENTORY
BURGESS
NORTHUMBERLAND CO

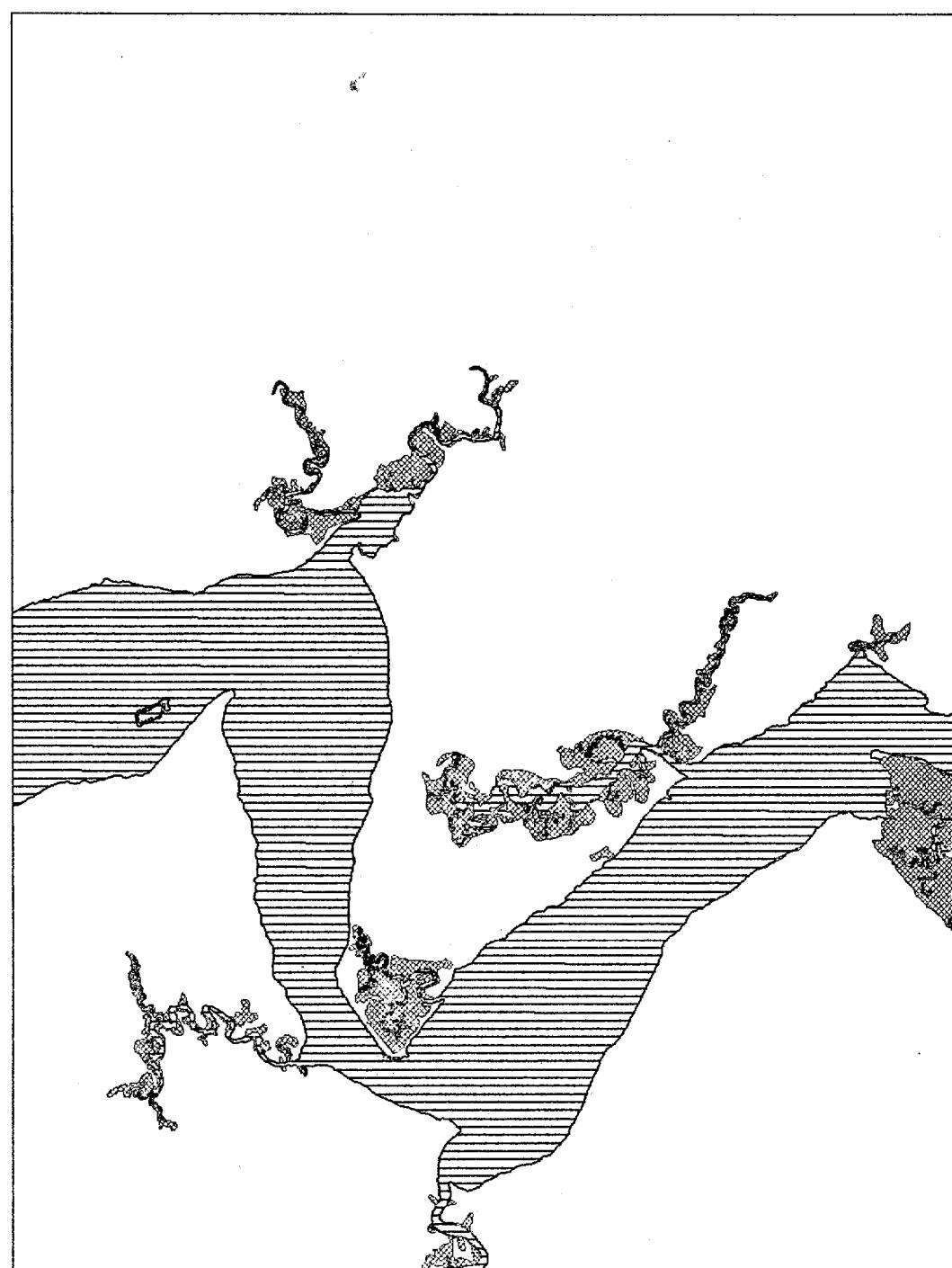
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— WATER



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VIMS TIDAL MARSH INVENTORY
CHAMPLAIN
WESTMORELAND CO

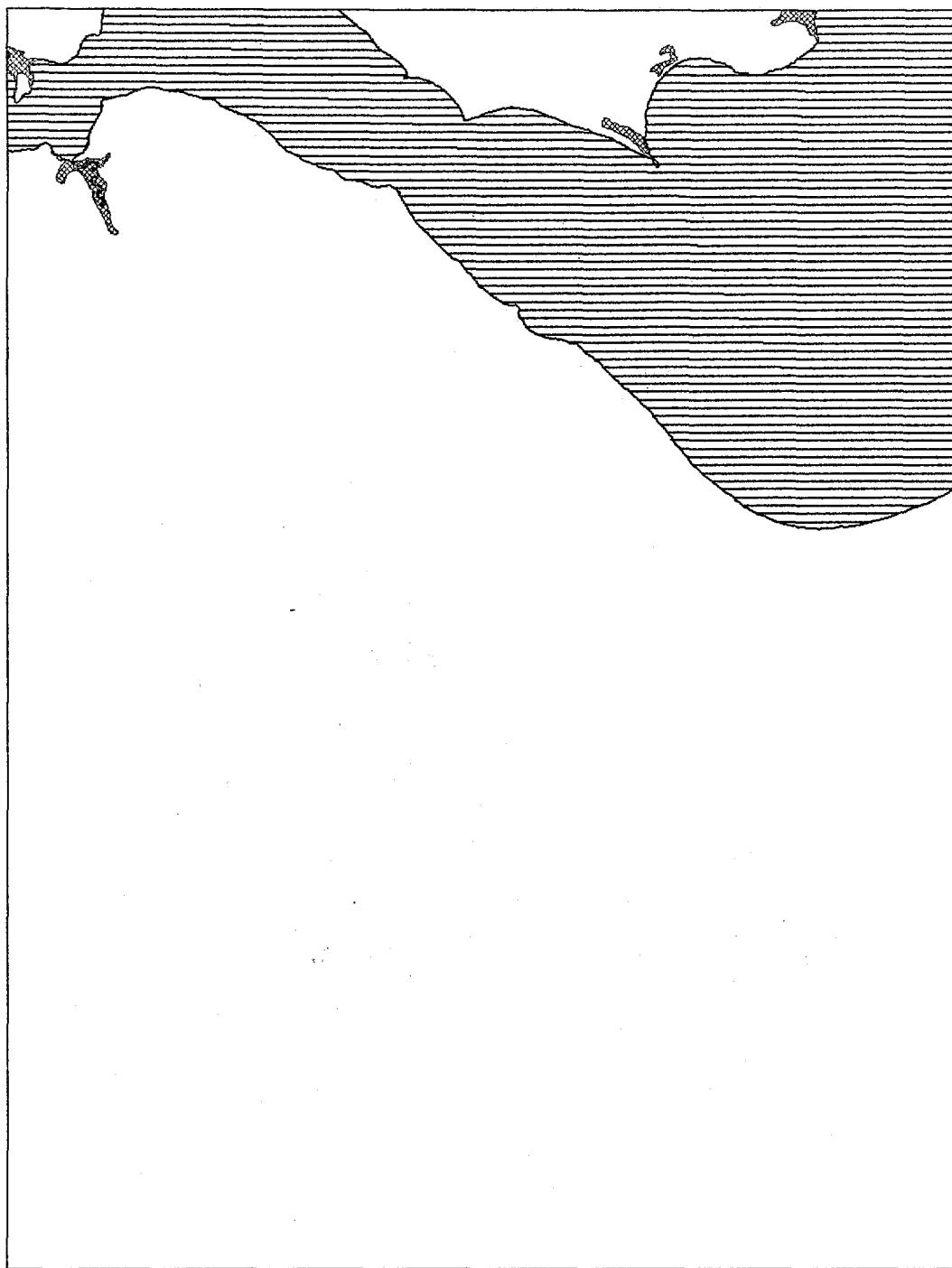
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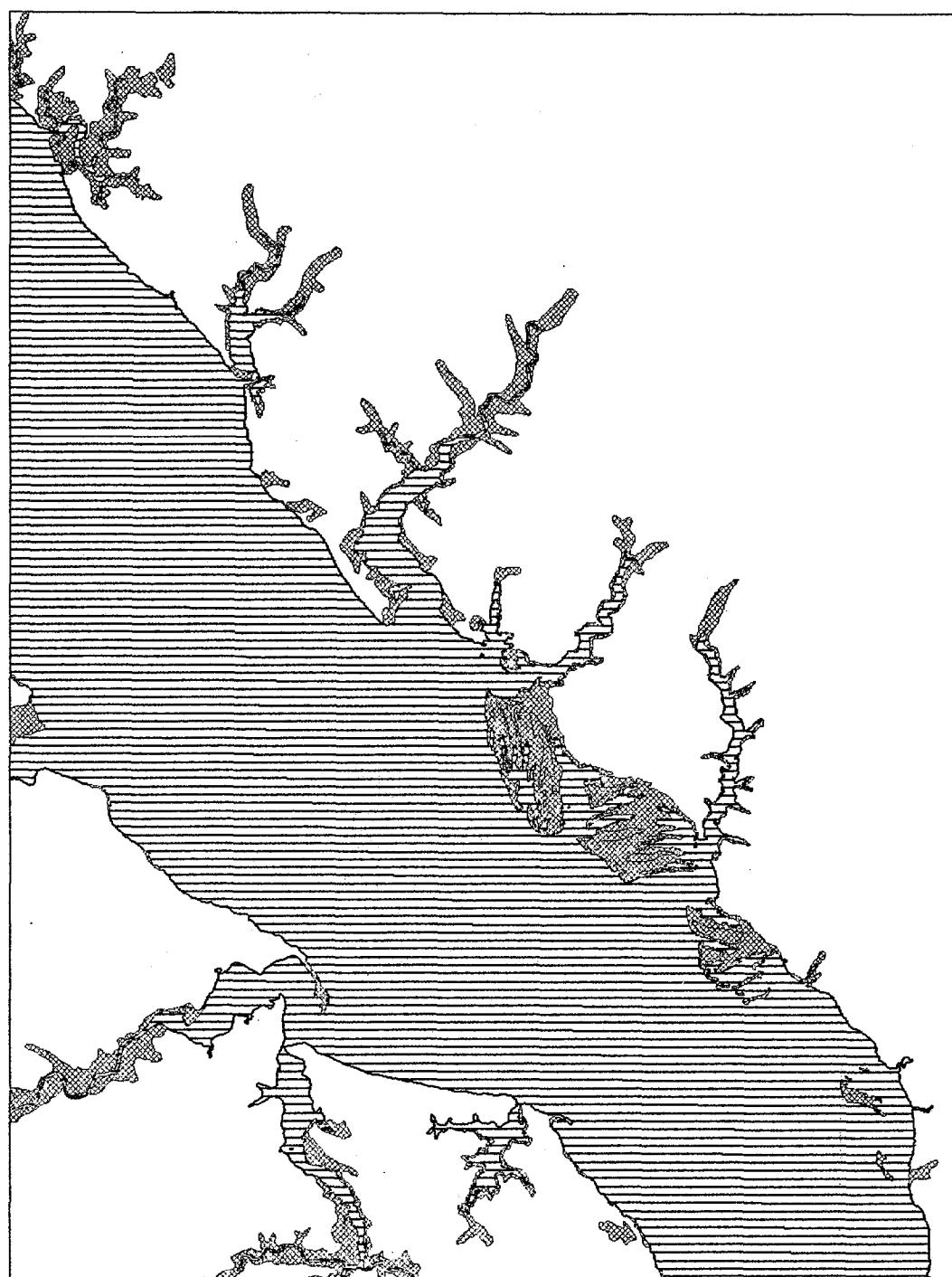
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CHARLES CITY COUNTY

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WETLANDS
WATER



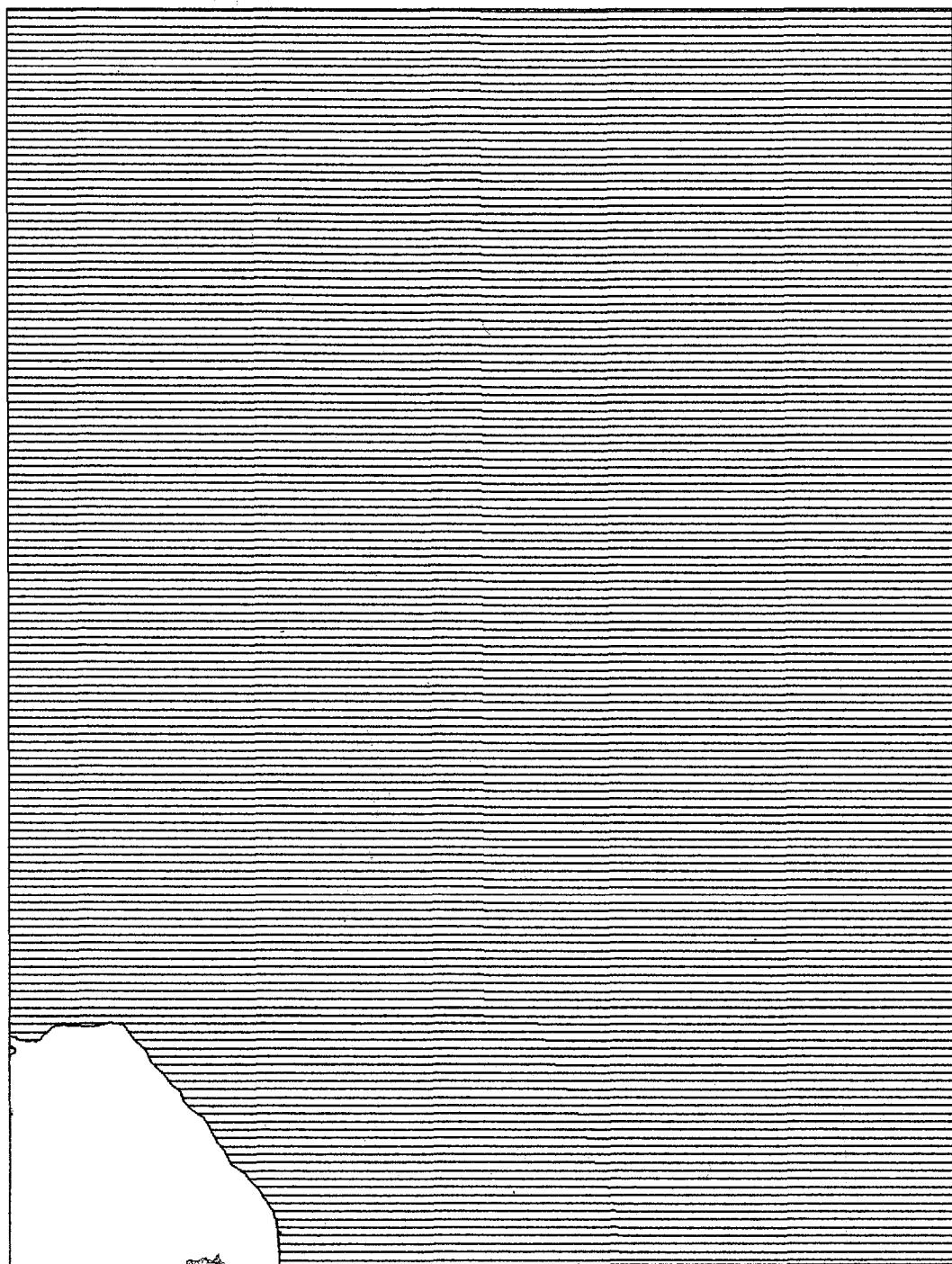
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PRINCE GEORGE COUNTY

TMI5506
■ WETLANDS
— WATER



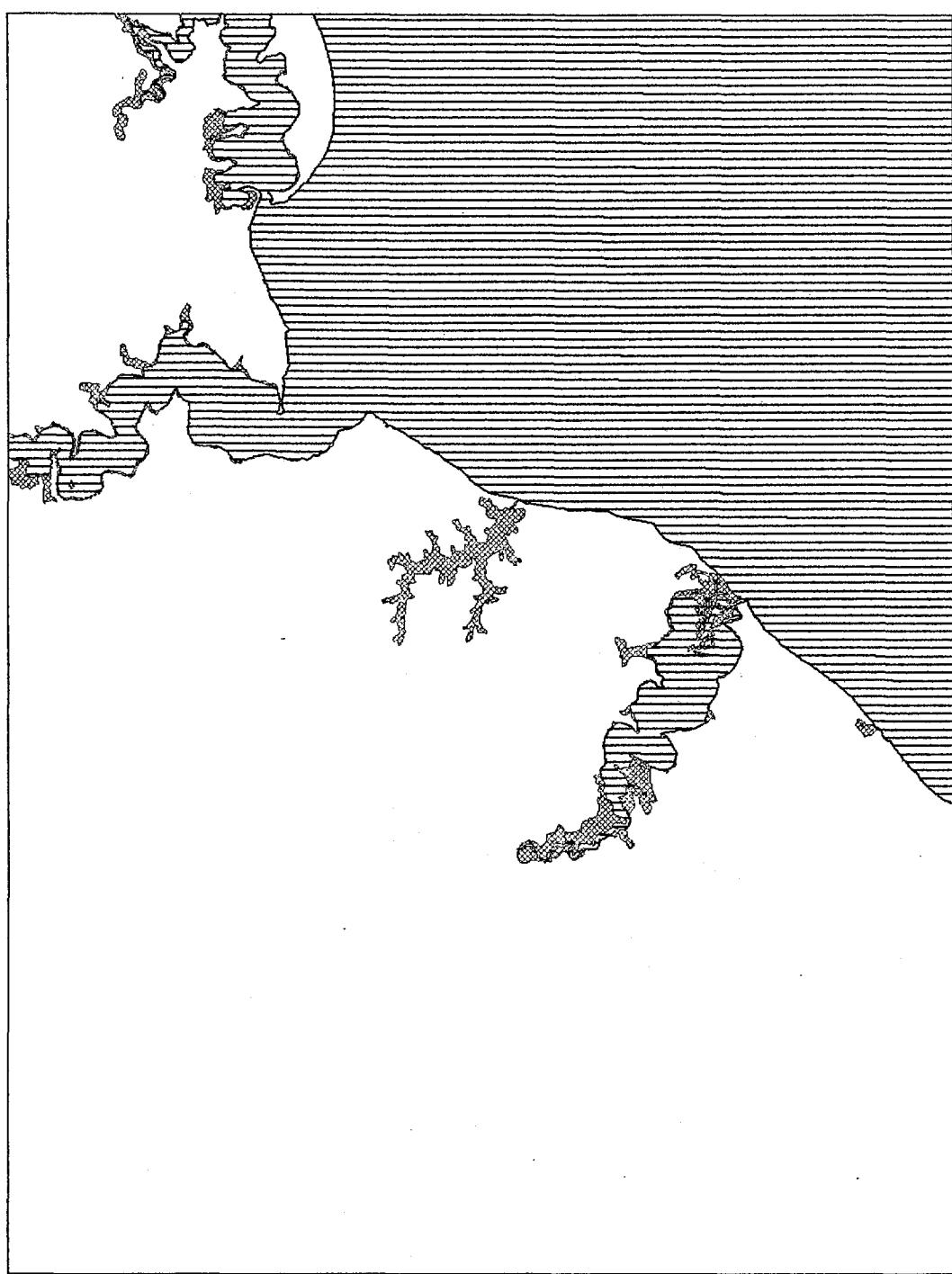
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CLAY BANK
GLOUCESTER COUNTY

TMI5807
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— WATER



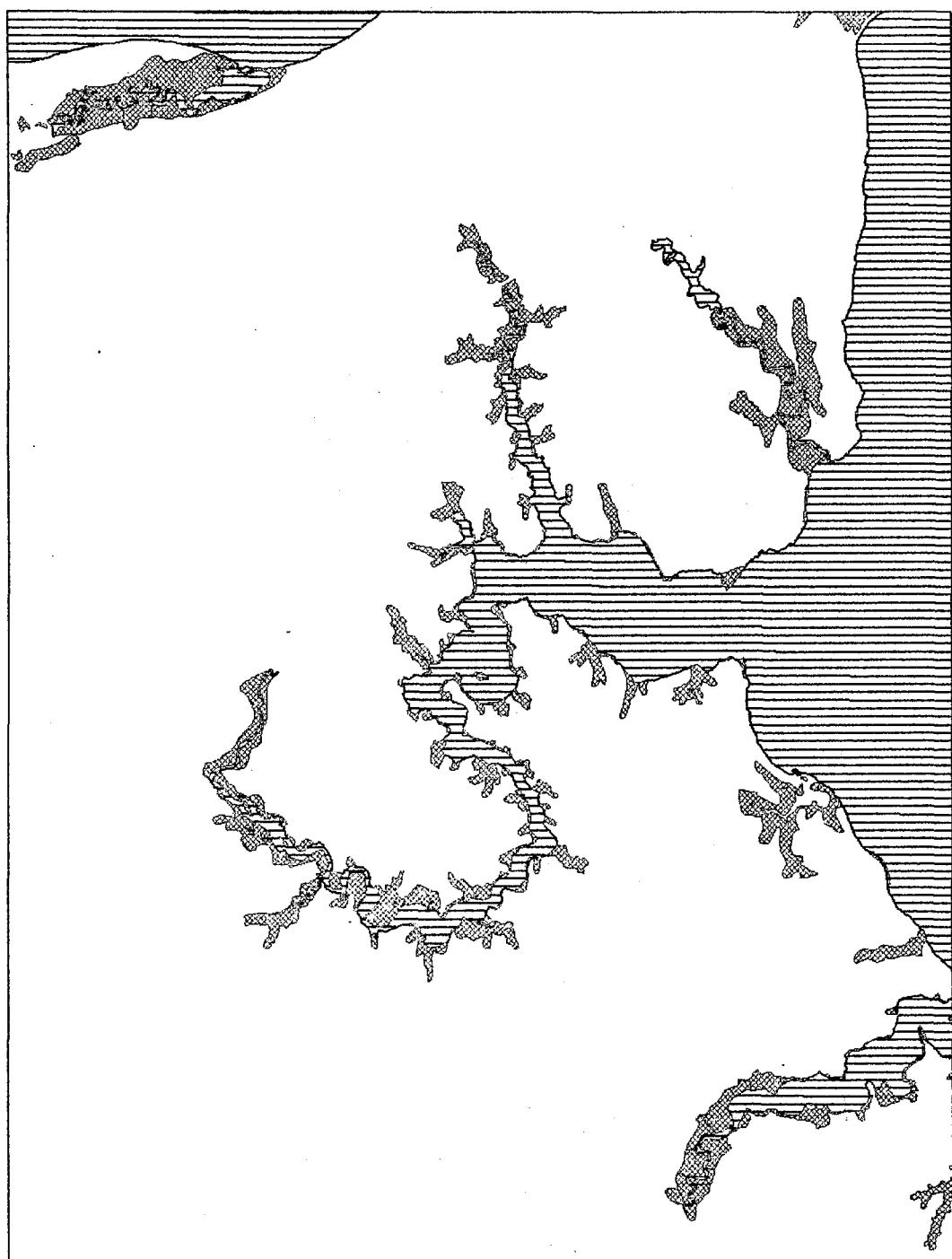
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COLONIAL BEACH NORTH
WESTMORELAND CO

TM15515
■ WETLANDS
== WATER



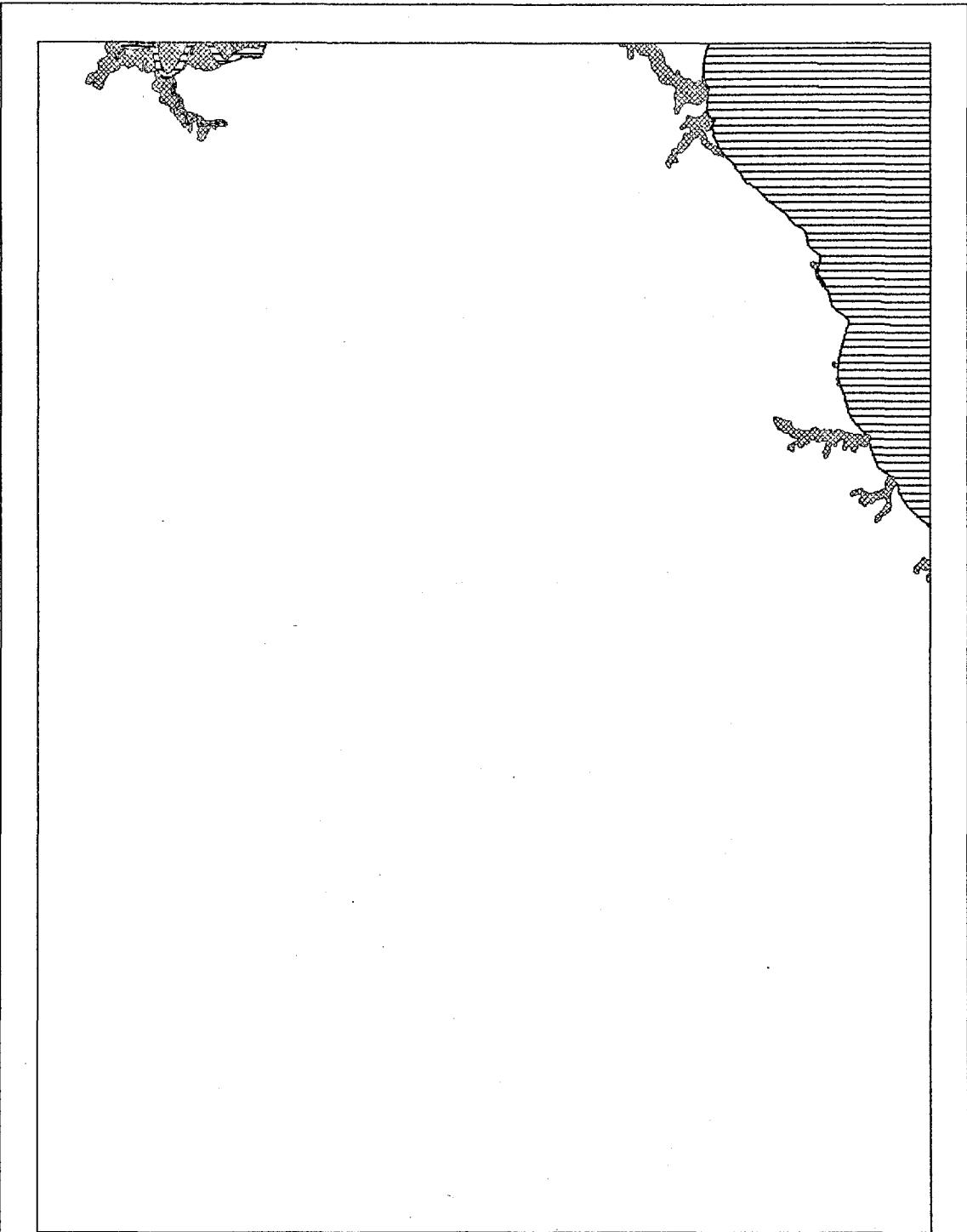
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WESTMORELAND CO

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— WATER



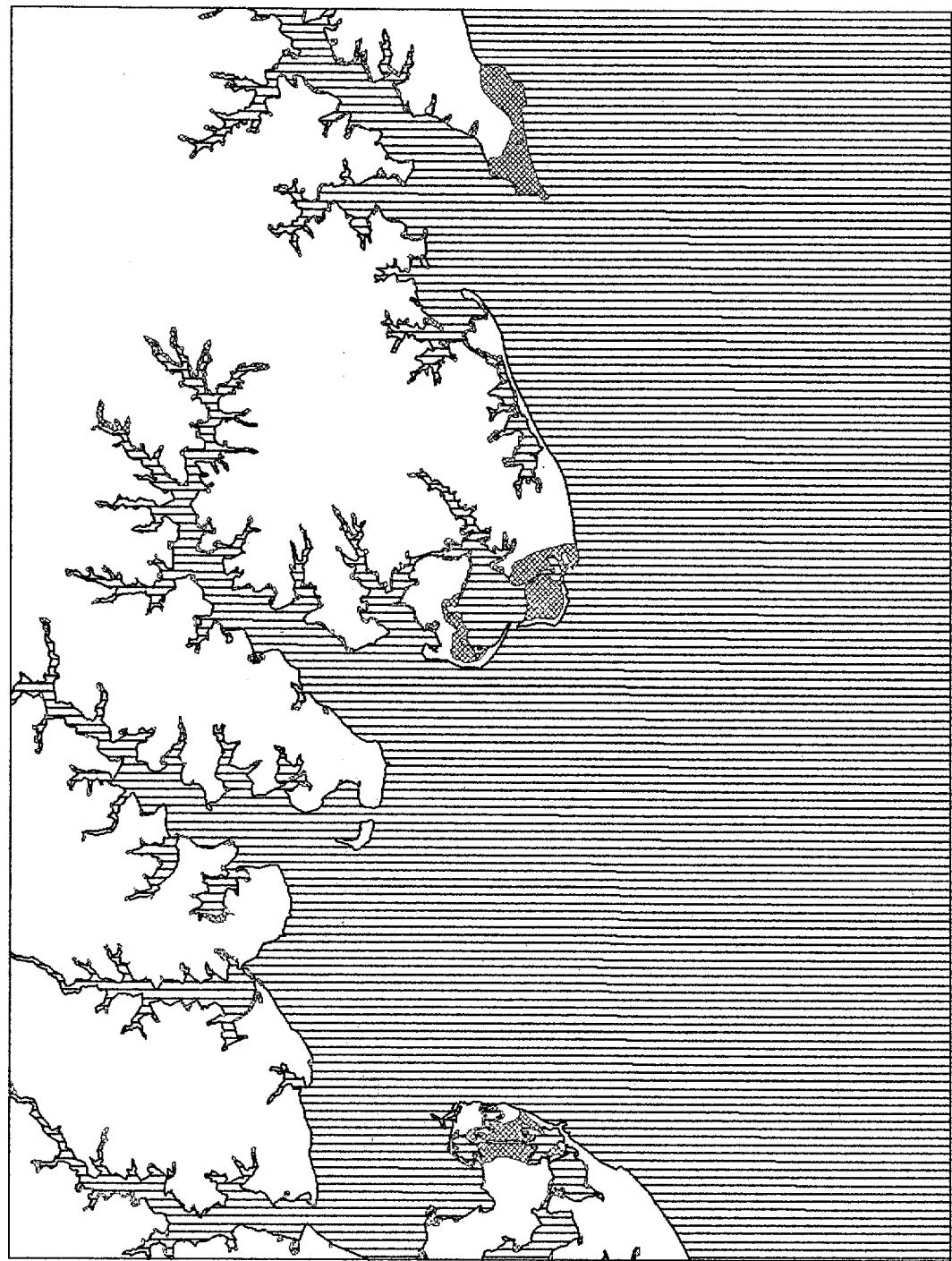
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DAHLGREN
WESTMORELAND CO

TM15415
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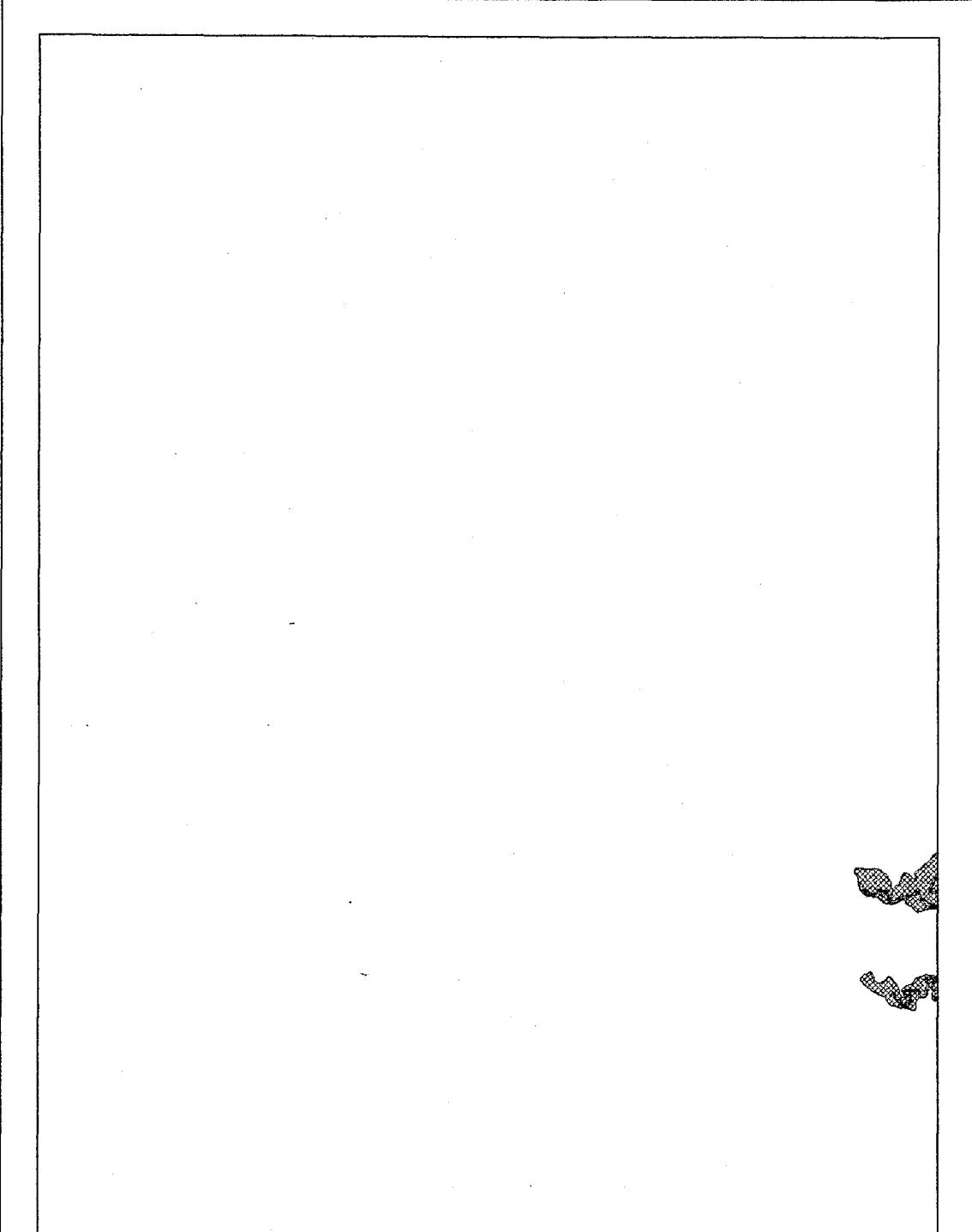
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DUNNSVILLE
ESSEX CO

TMI5611
■ WETLANDS
= WATER



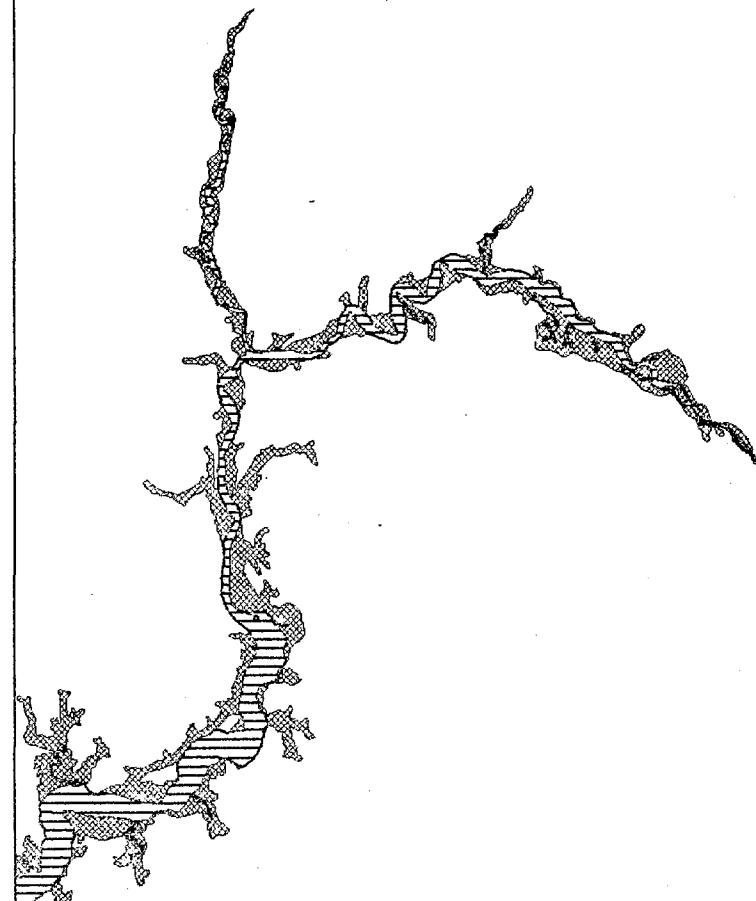
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FLEETS BAY
LANCASTER CO

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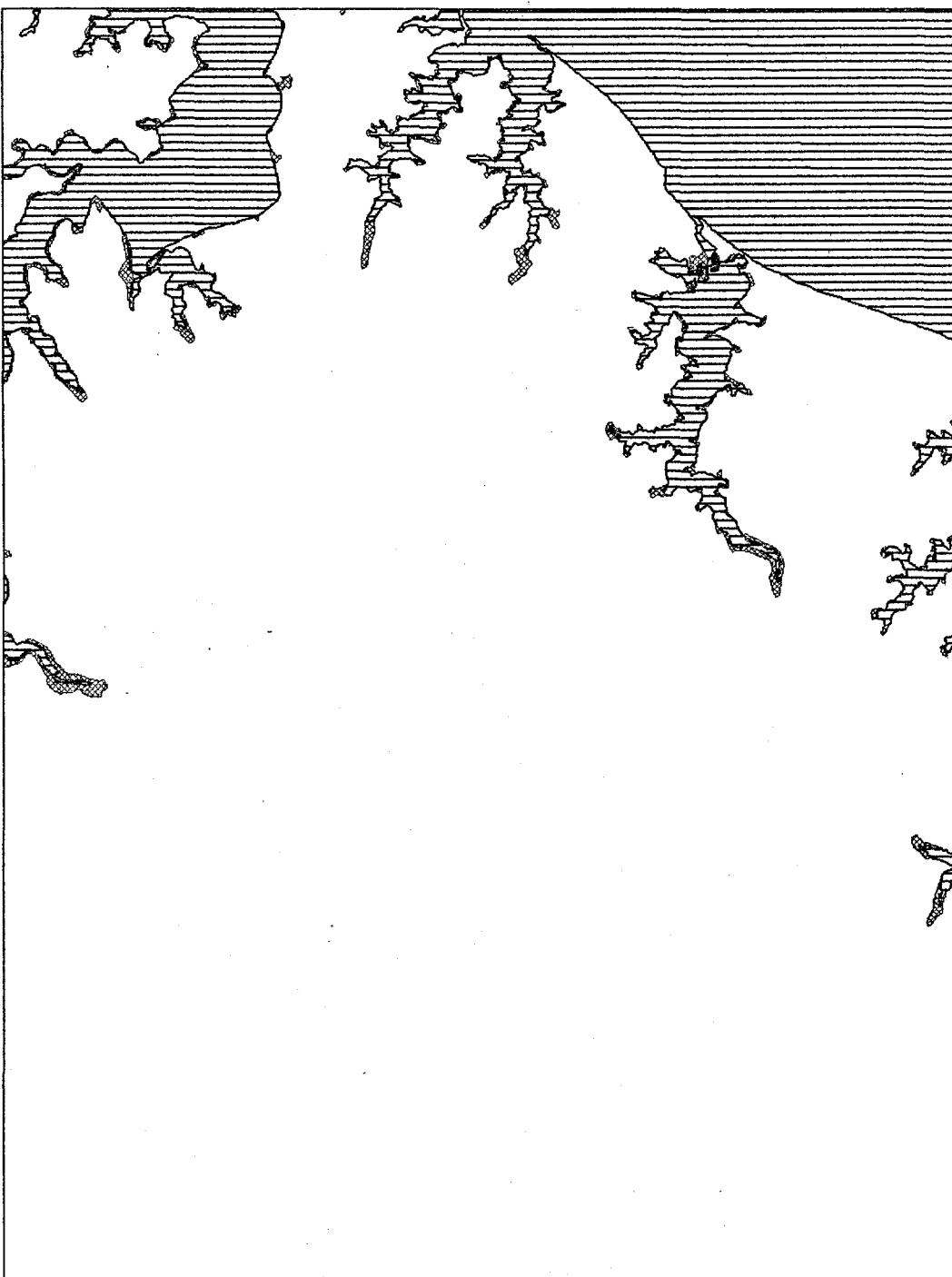
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GLOUCESTER CO

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■ WETLANDS
= WATER



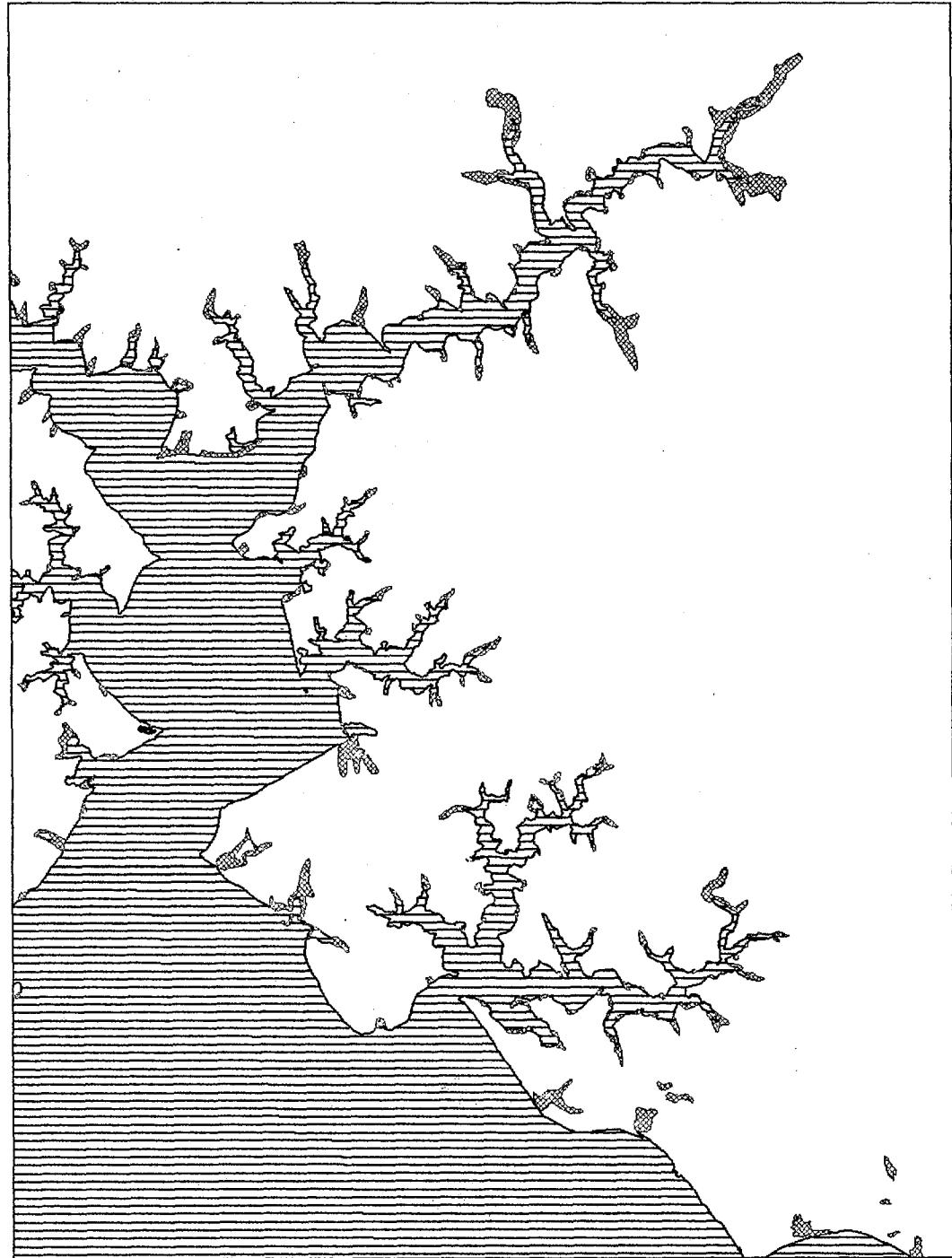
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RICHMOND CO

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== WATER



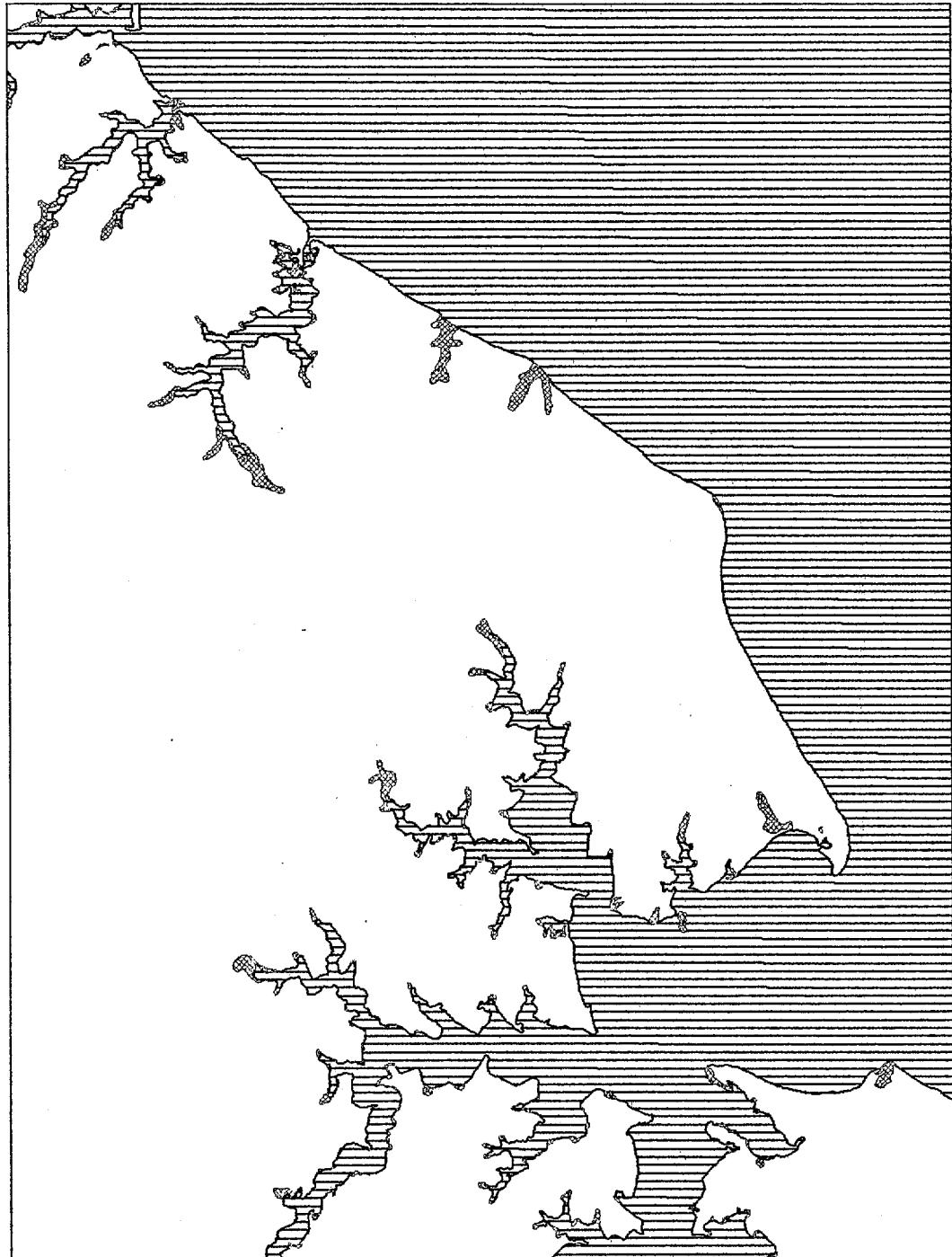
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WATER



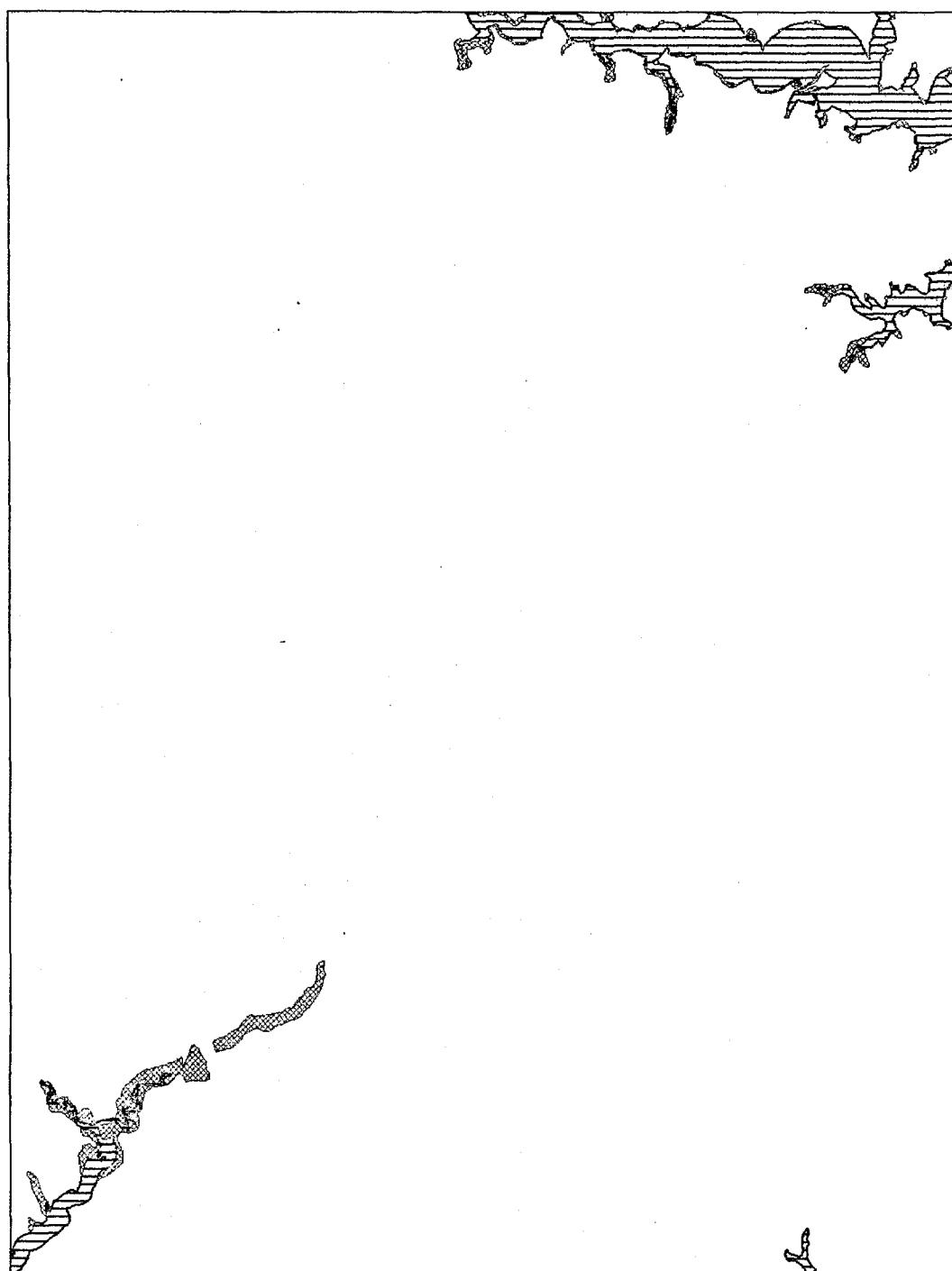
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LANCASTER CO

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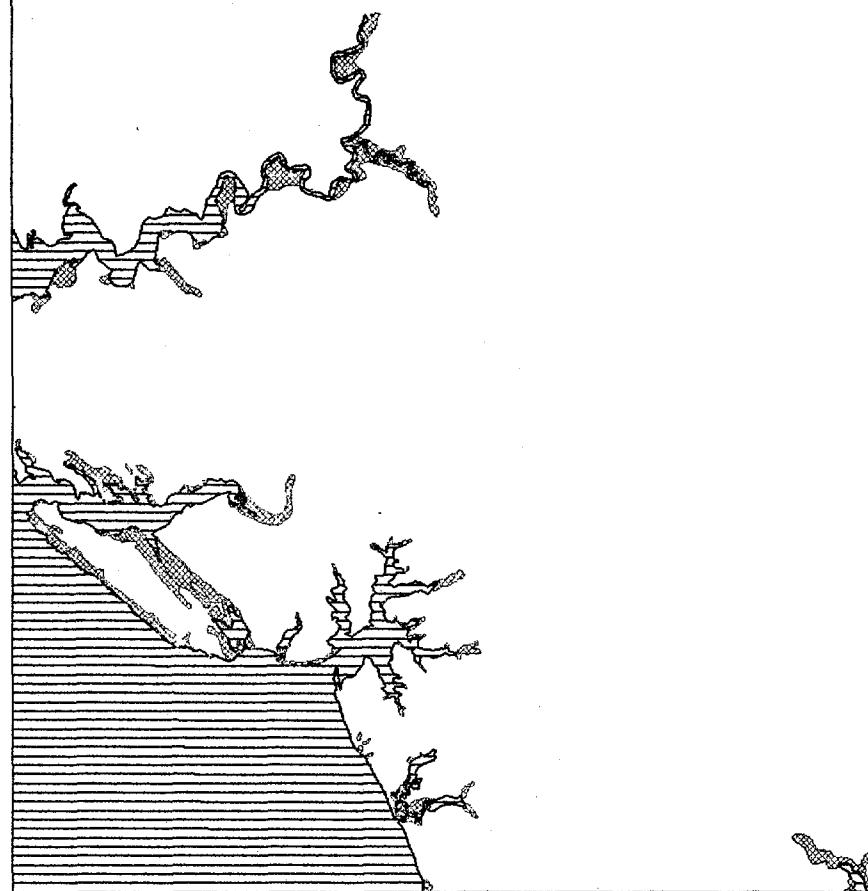
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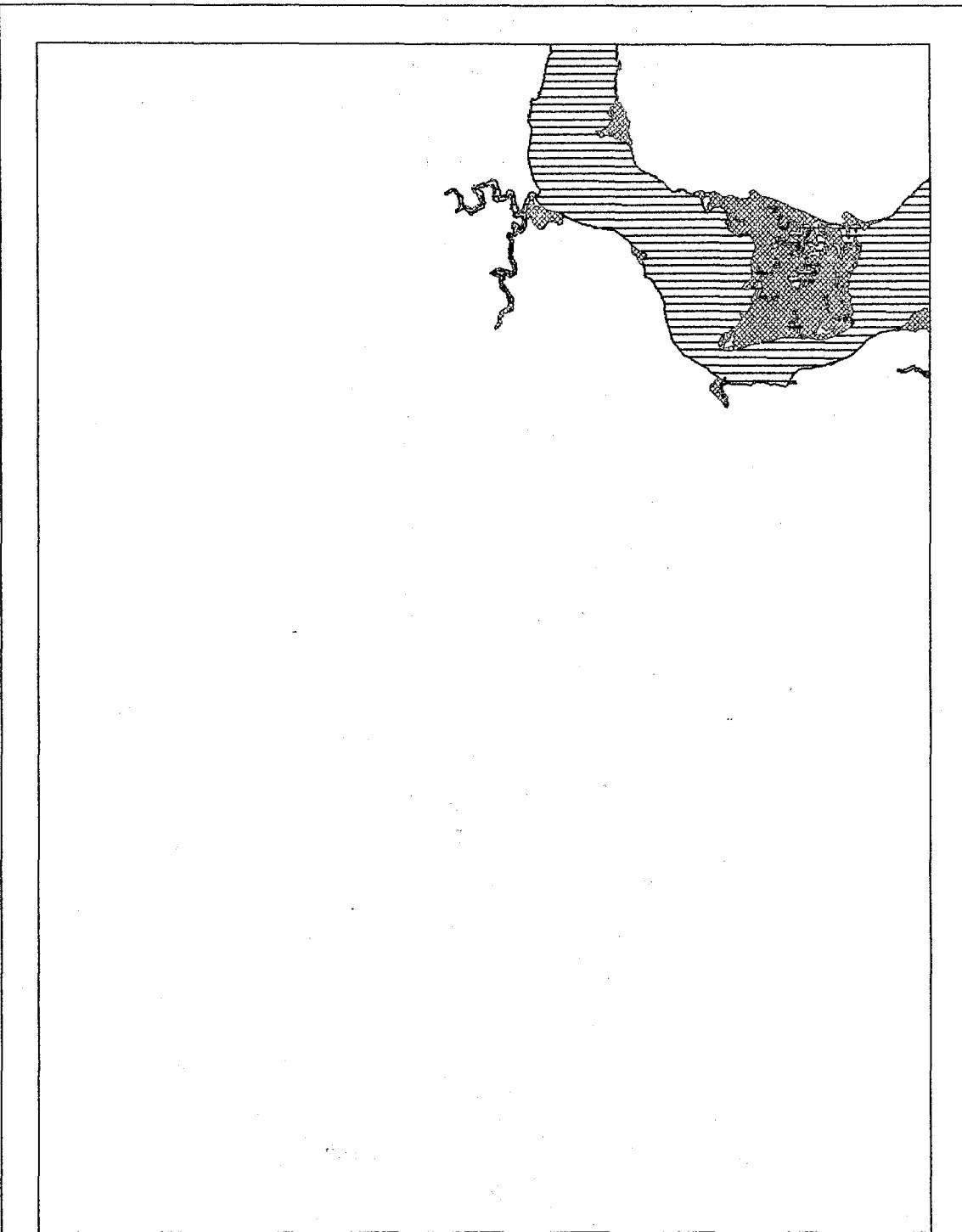
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LANCASTER CO

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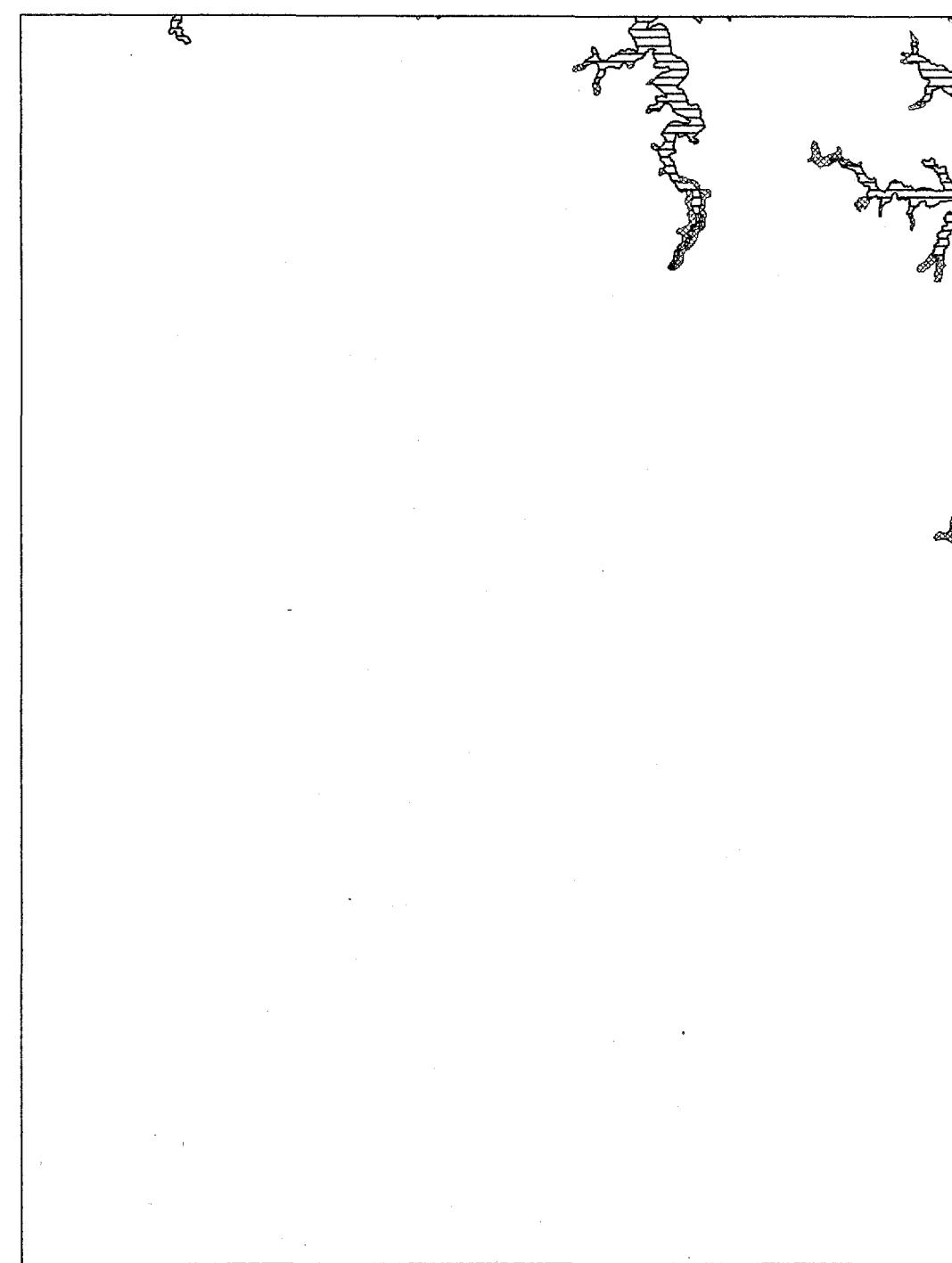
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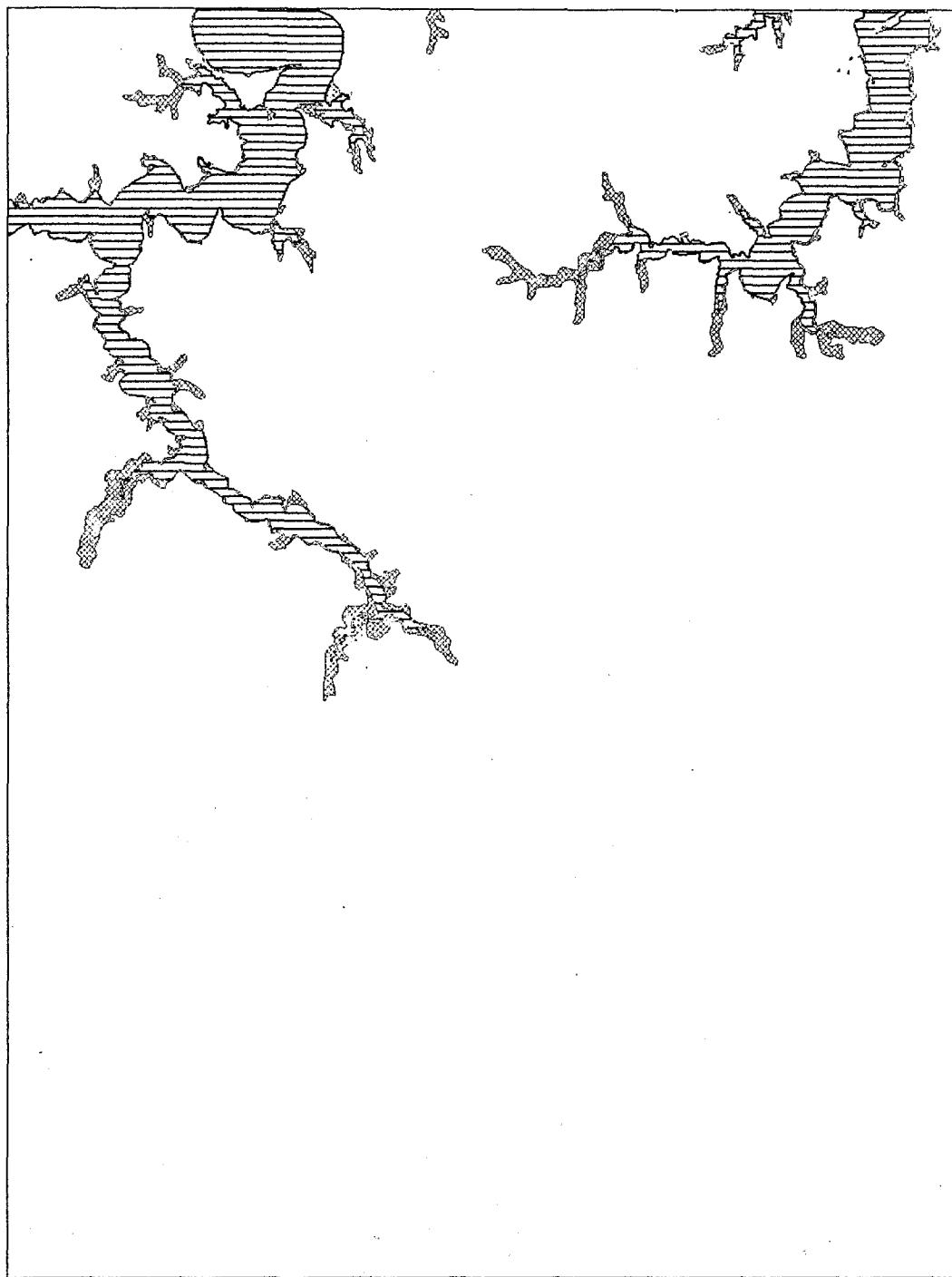
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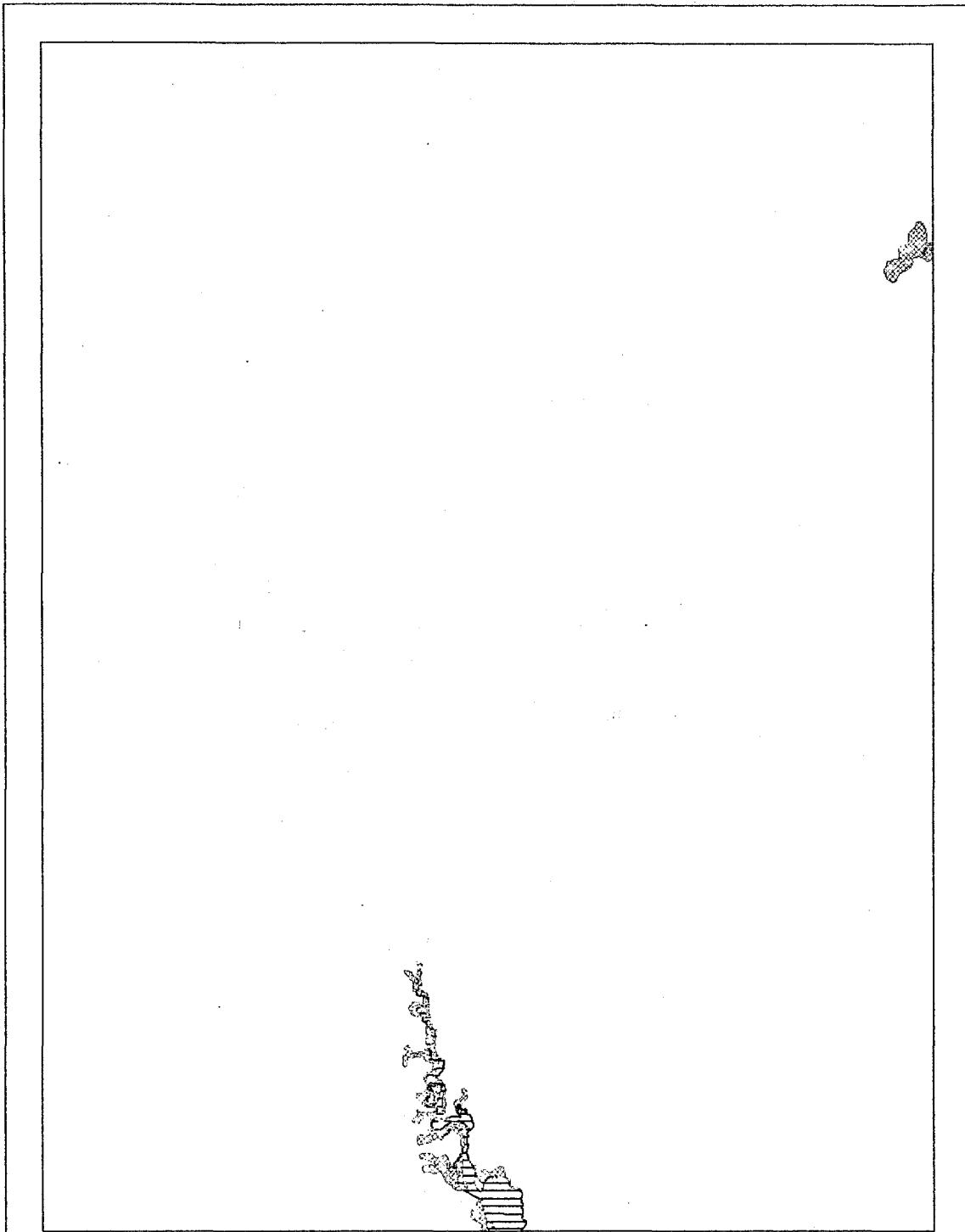
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NORTHUMBERLAND COUNTY

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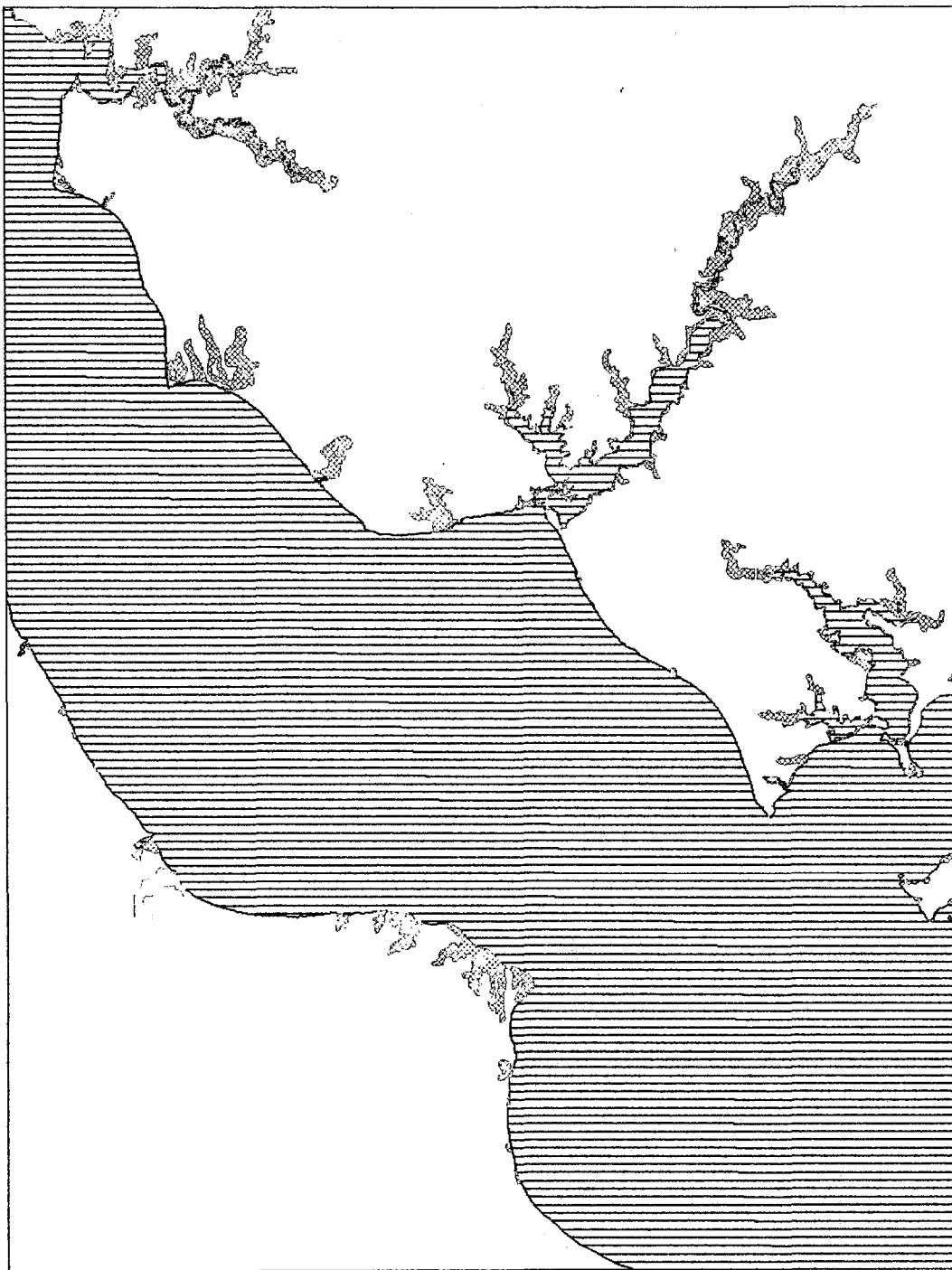
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MACHODOC
WESTMORELAND COUNTY

TM15713
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— WATER



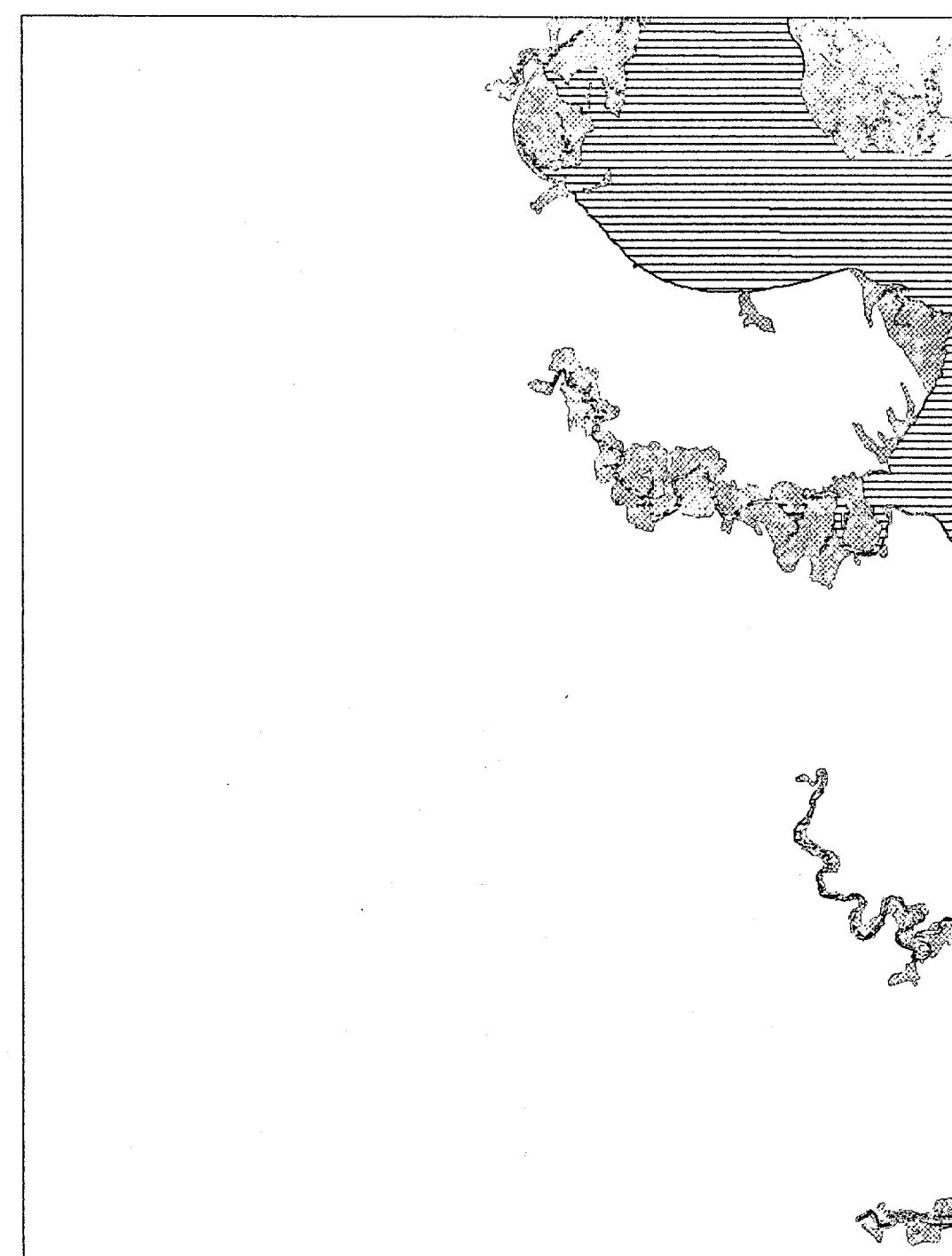
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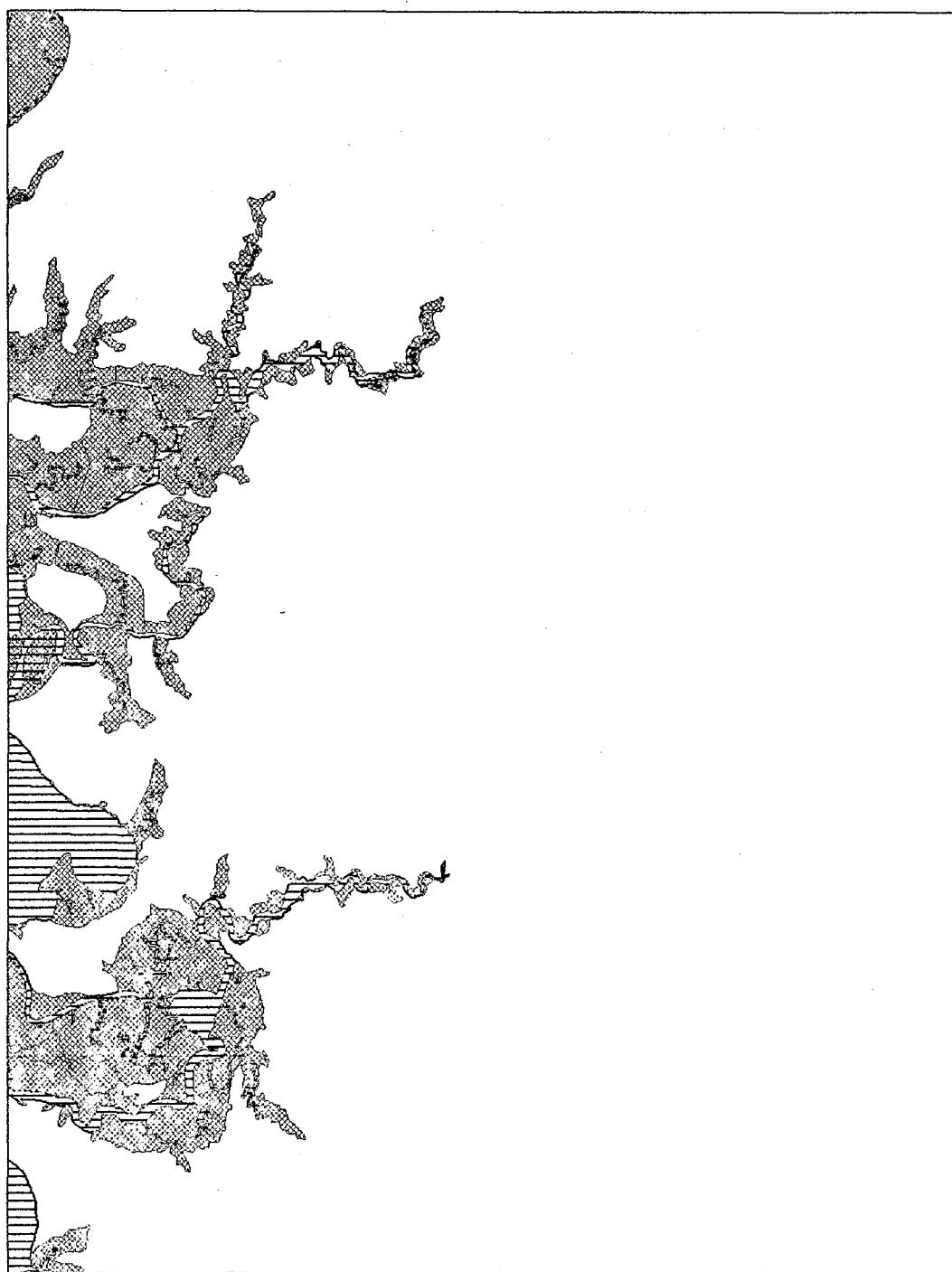
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TM15711
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WATER



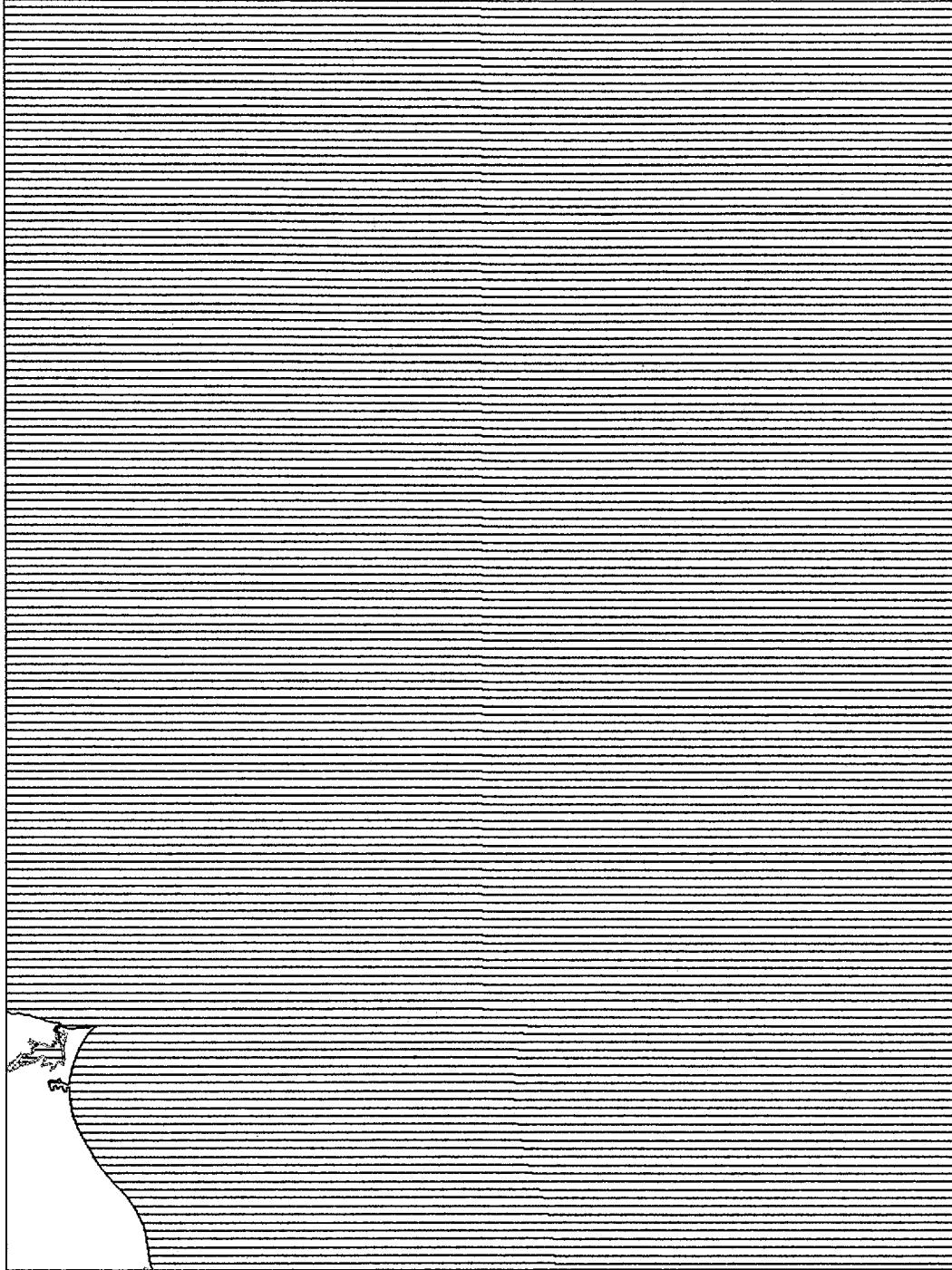
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ESSEX CO

TMI 5512
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WATER



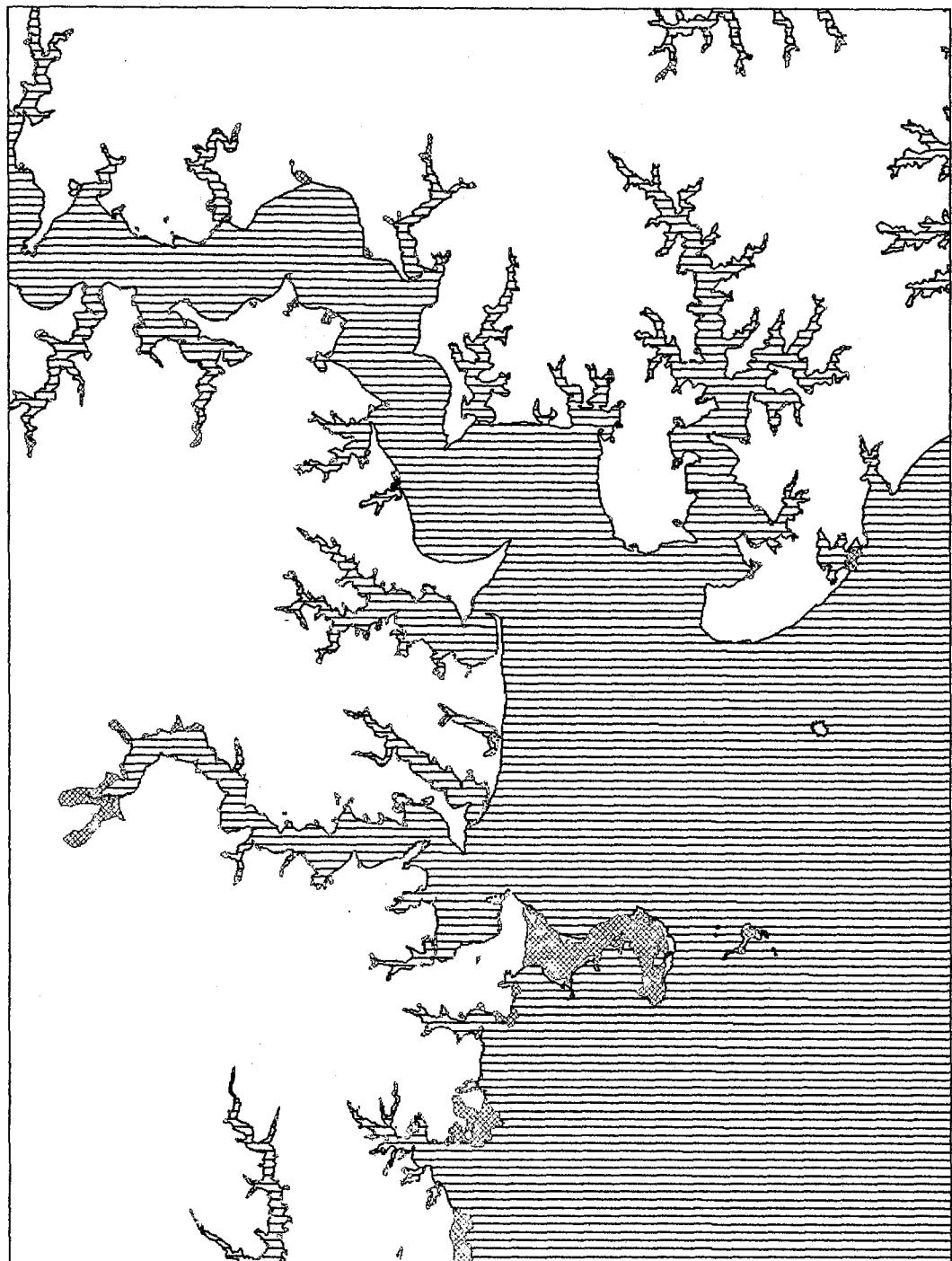
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NORGE
JAMES CITY COUNTY

TMI5607
■ WETLANDS
— WATER



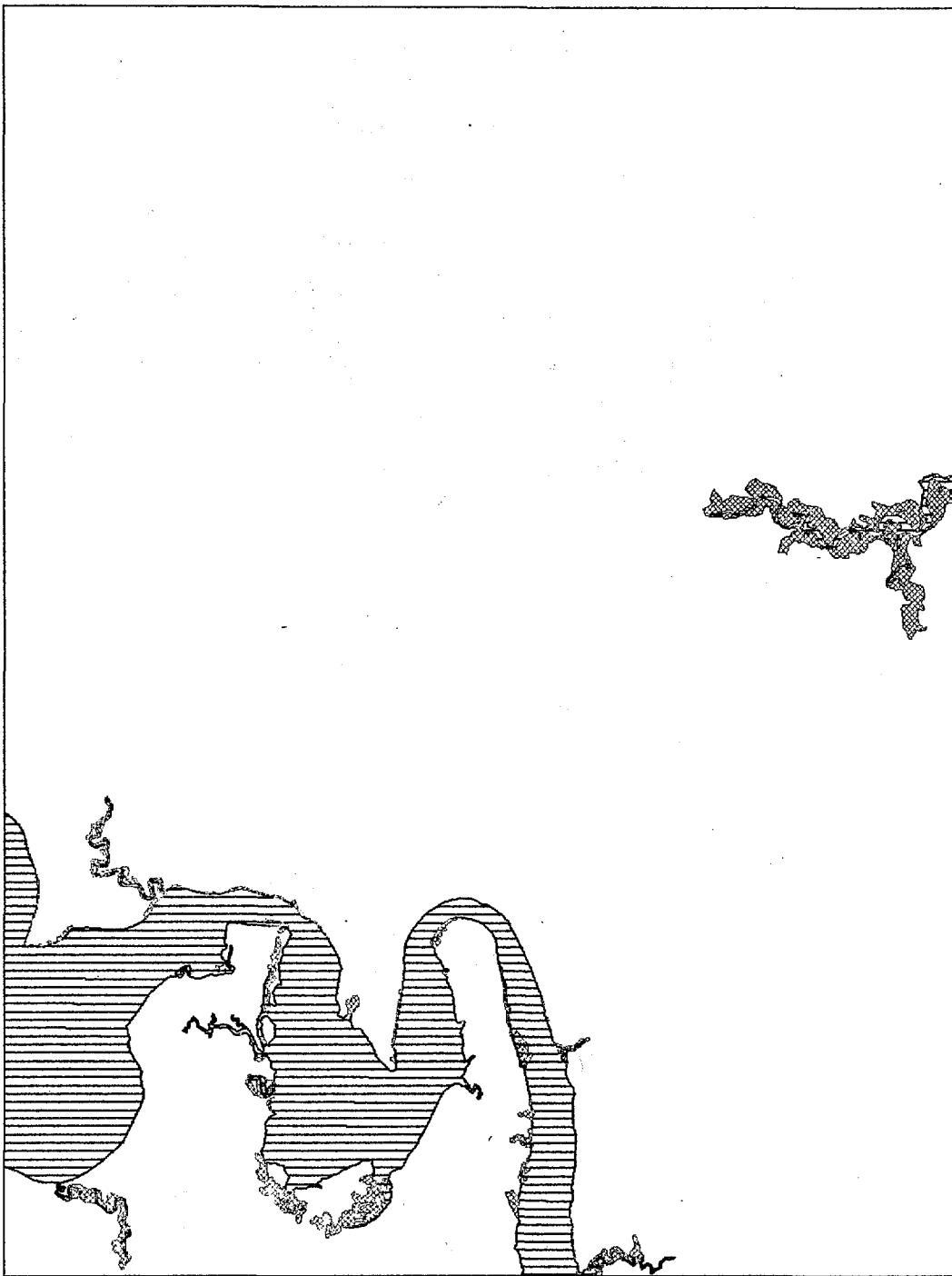
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WESTMORELAND CO

TM15814
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= WATER



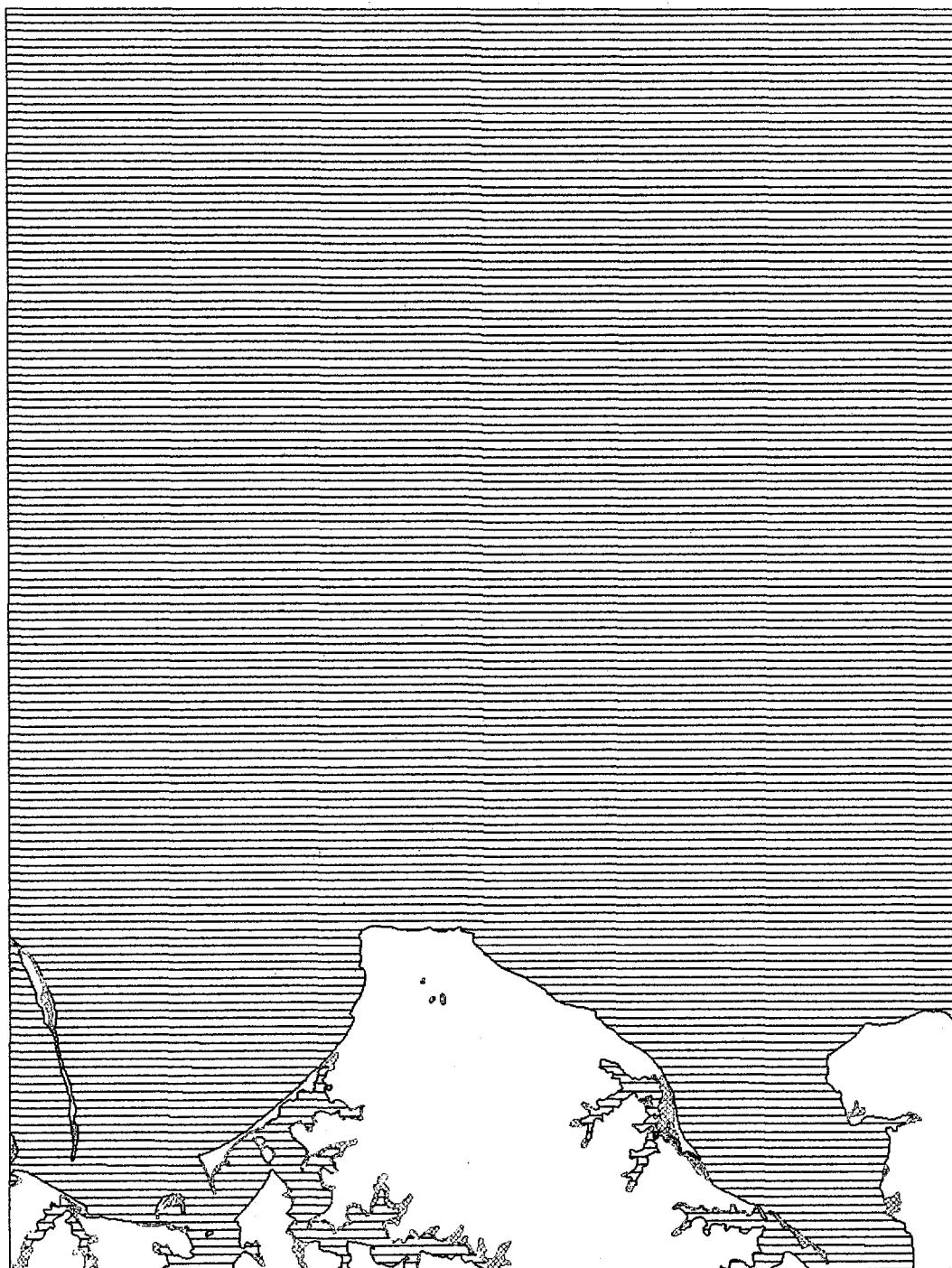
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NORTHUMBERLAND CO

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VIMS TIDAL MARSH INVENTORY
ROLLINS FORK
WESTMORELAND CO

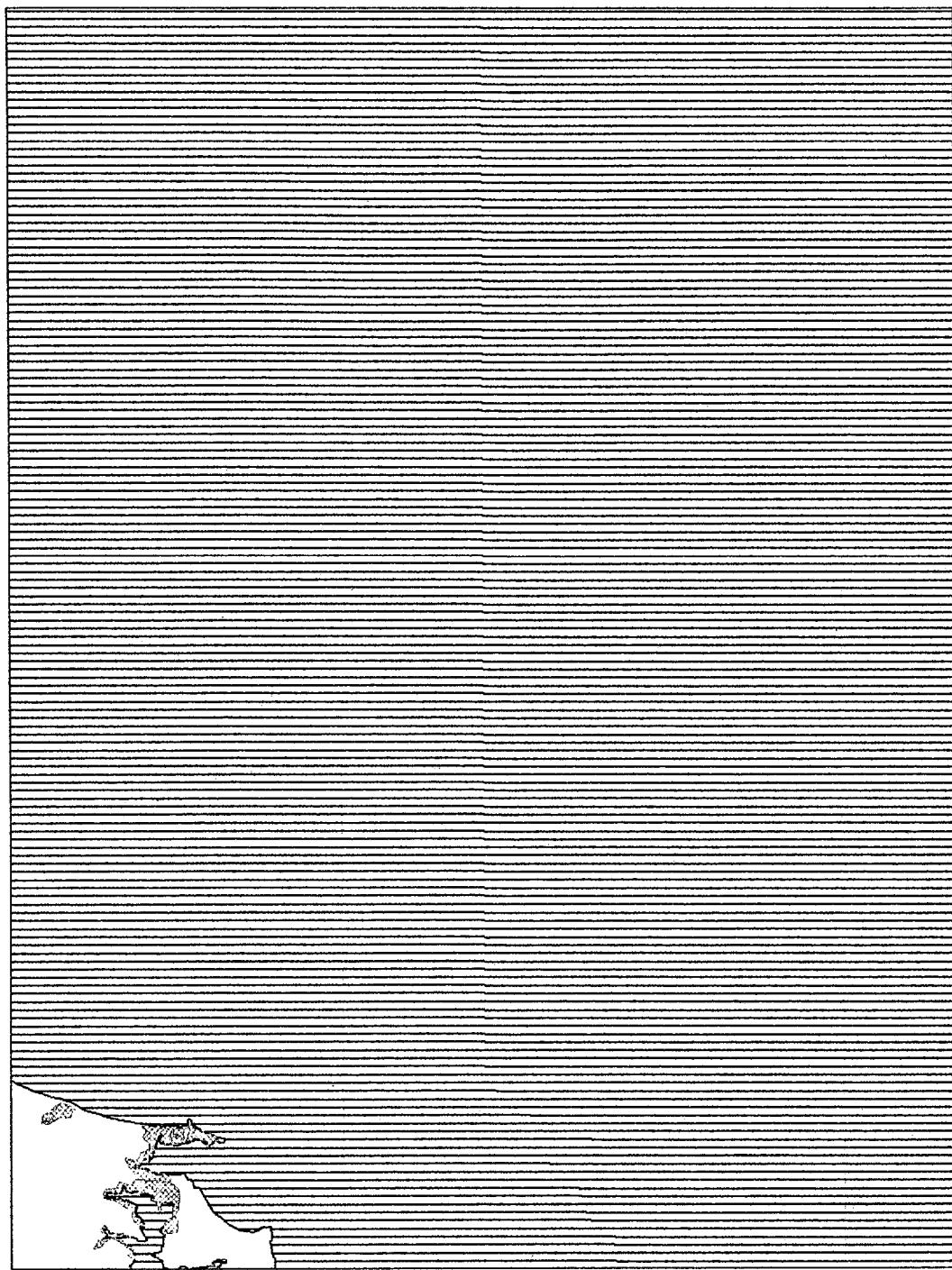
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VIMS COASTAL INVENTORIES
VIMS TIDAL MARSH INVENTORY
ST. CLEMENTS ISLAND
WESTMORELAND COUNTY

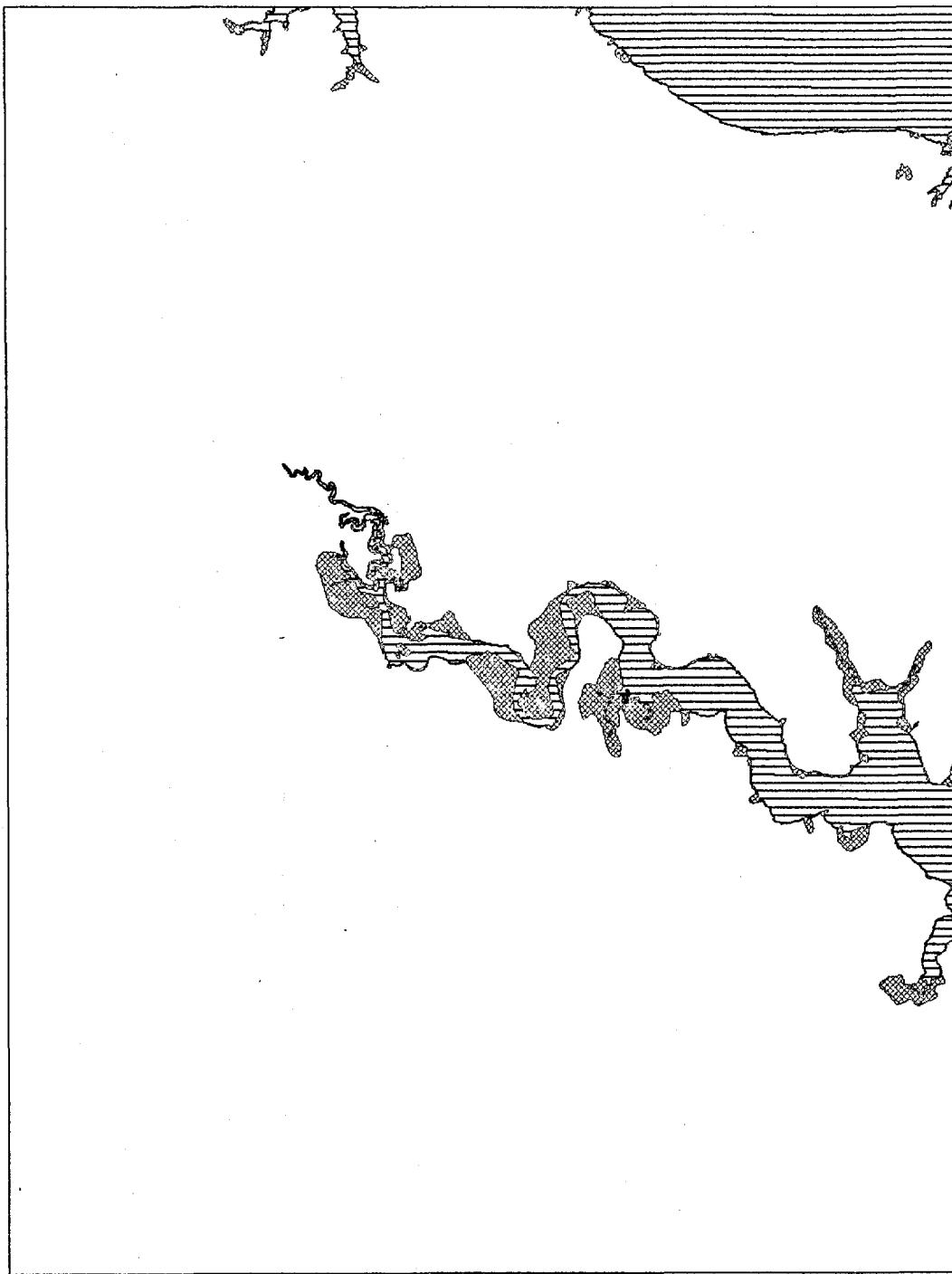
TM15714

■ WETLANDS
— WATER



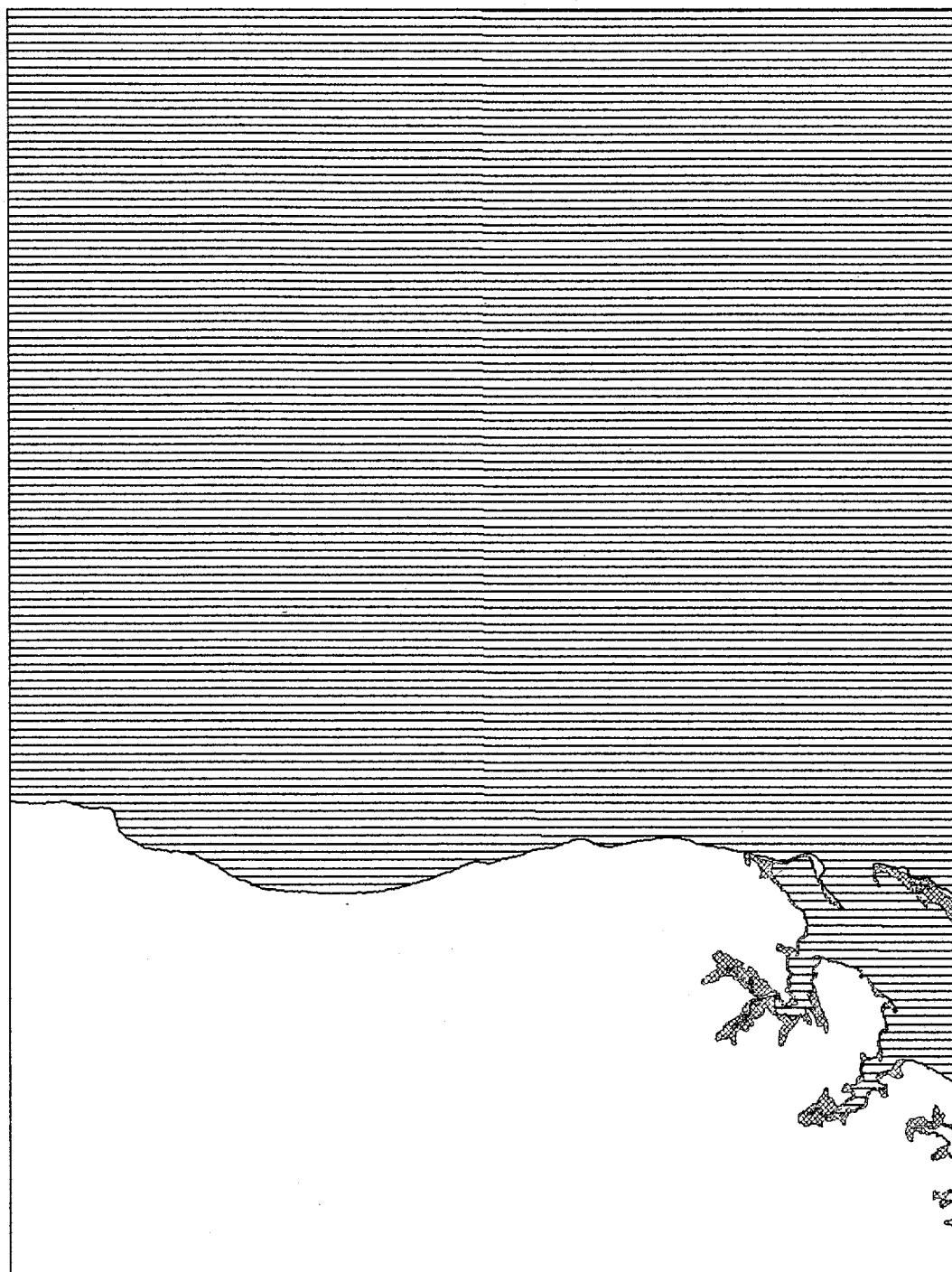
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VIMS TIDAL MARSH INVENTORY
ST. GEORGE ISLAND
NORTHUMBERLAND CO

TM15913
■ WETLANDS
= WATER



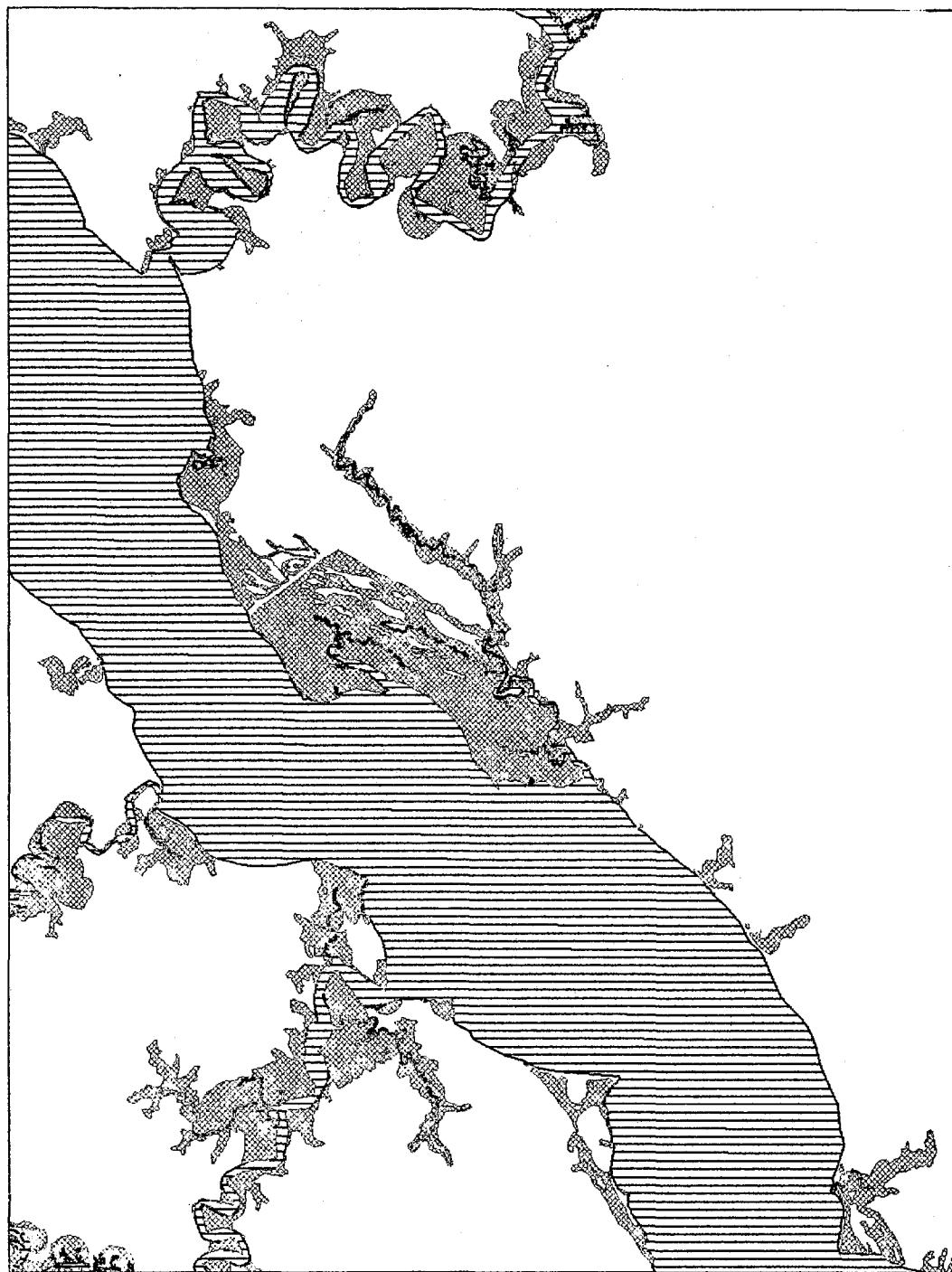
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VIMS TIDAL MARSH INVENTORY
SALUDA
MIDDLESEX CO

TM15809
■ WETLANDS
= WATER



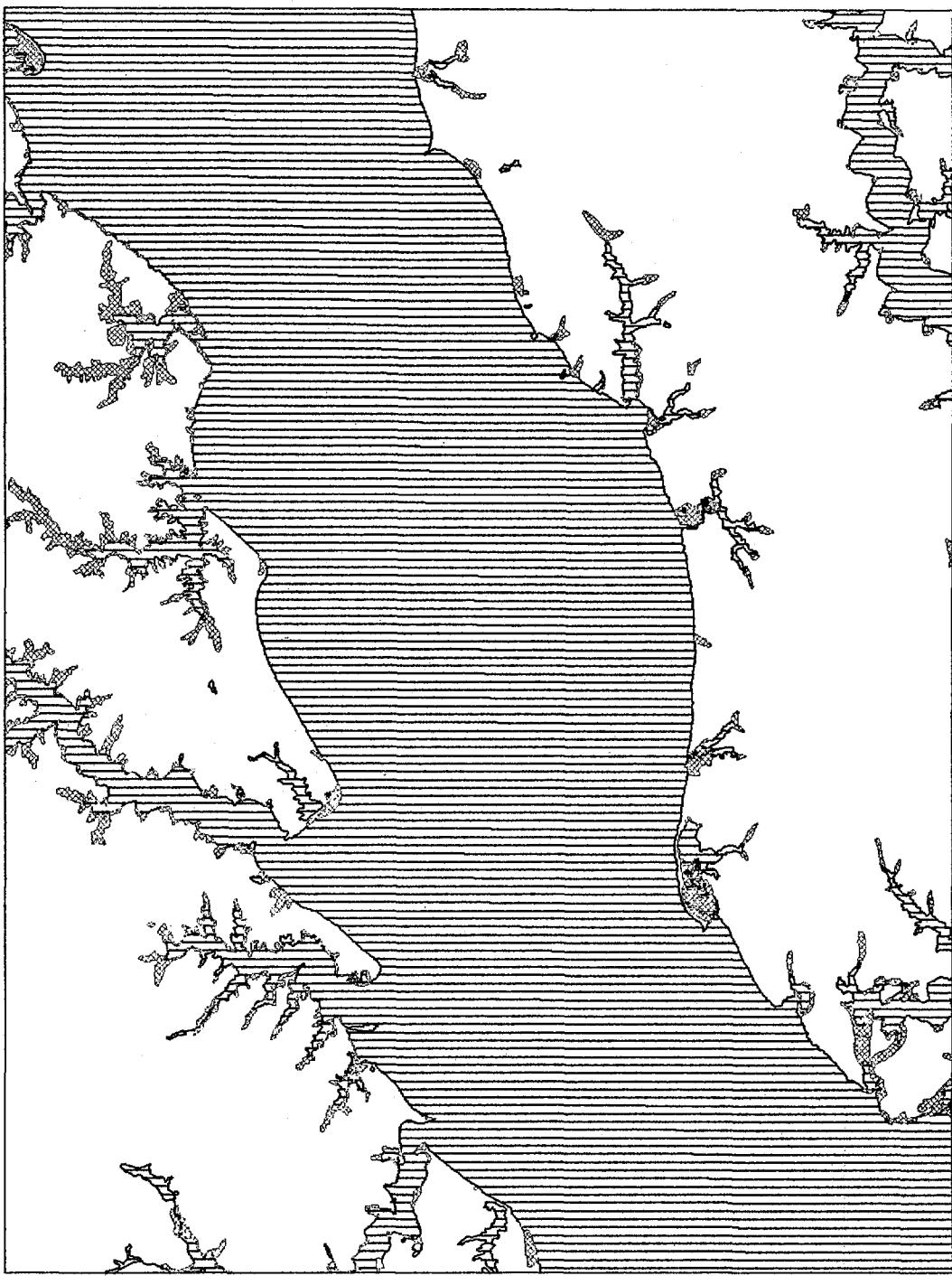
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VIMS TIDAL MARSH INVENTORY
STRATFORD HALL
WESTMORELAND COUNTY

TMI5614
WETLANDS
WATER



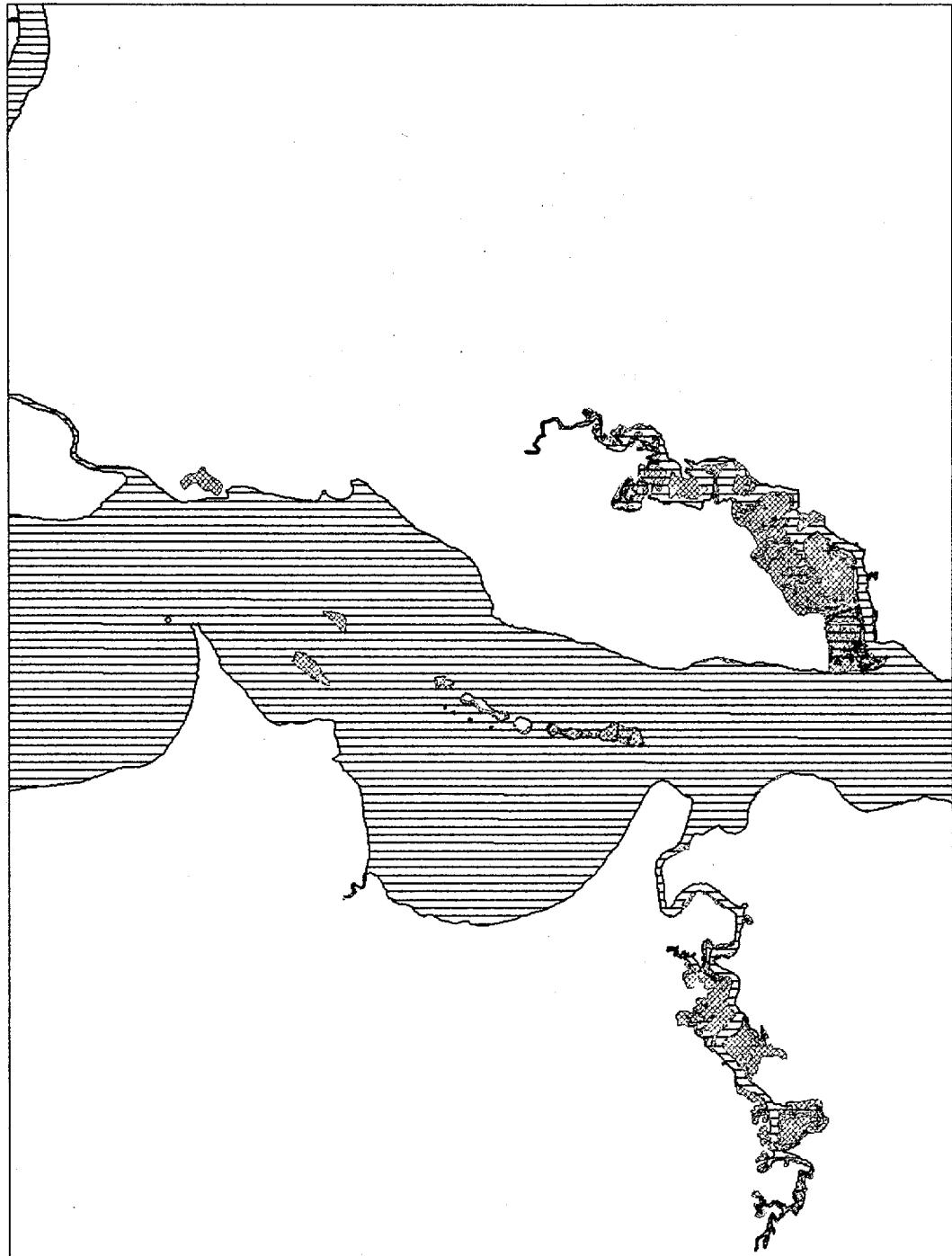
VIMS COASTAL INVENTORIES
VIMS TIDAL MARSH INVENTORY
TAPPAHANNOCK
RICHMOND CO

TM15612
■ WETLANDS
= WATER



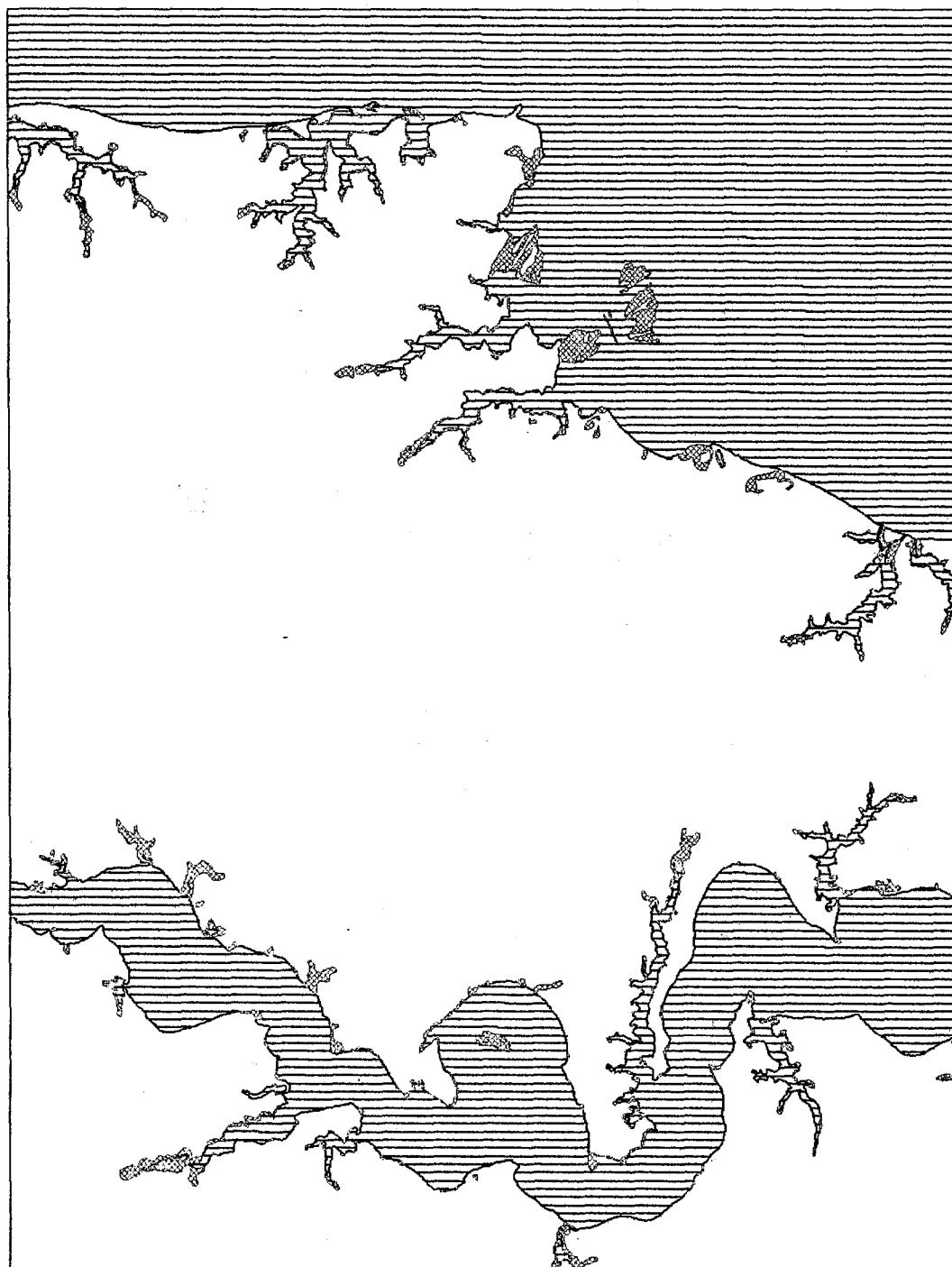
VIMS COASTAL INVENTORIES
VIMS TIDAL MARSH INVENTORY
URBANNA
LANCASTER CO

TM15810
■ WETLANDS
= WATER



VIMS COASTAL INVENTORIES
VIMS TIDAL MARSH INVENTORY
WESTOVER
CHARLES CITY COUNTY

TM15307
WETLANDS
— WATER



VIMS COASTAL INVENTORIES
VIMS TIDAL MARSH INVENTORY
WILTON
MIDDLESEX CO

TM15909
■ WETLANDS
= WATER

CHAPTER XII. LEFT/RIGHT BANK COVERAGE

XII. LEFT/RIGHT BANK COVERAGE

The Left/Right Bank (LRB) shoreline coverage is derived from the U.S. Geological Survey Digital Line Graph Data (DLG). The coverage is created by selecting only the shoreline from the hydrography Digital Line Graph. The survey was originally digitized by the U.S. Geological Survey at a scale of 1:100,000. The coverage serves as the current base shoreline for much of the VIMS Shoreline Inventory Report data collected in the mid to late 70's and updated in 1985, and the transportation network coverage supplied by the U.S. Geological Survey. Plots of the 1:100,000 shoreline can be found in the River Reach Coverage section (ref. Chapter 13). A folio is not included in this chapter, but documentation is presented here.

GEOGRAPHIC DATA SET DESCRIPTION

VIMS GIS Lab Prefix LRB

Data Layer Name LEFT/RIGHT BANK

Description ONLY LEFT/RIGHT BANK SHORELINE DERIVED FROM THE USGS
DIGITAL LINE GRAPH OF HYDROGRAPHY.

Year(s) Collected VARIES

Base Maps used for Digitizing DIGITIZED BY USGS

Digitizing Scale 1:100000

Geographic Extent SELECTED AREAS OF COASTAL VIRGINIA

How Collected (Describe):

THE HYDROGRAPHY COMES FROM USGS MAPS.

Actual/Intended Use or Purpose:

THE LRB COVERAGE IS USED AS A BASE MAP FOR WORK DONE ON A 1:100000
SCALE (IE. RIVER REACH COVERAGE INFORMATION).

VA TIDAL RIVERS INVENTORY
AVERAGE TIME AND DISC SPACE USED*

LEFT-RIGHT BANK COVERAGE

| MAP
NUMBER | TIME | DISC
SPACE |
|---------------|------|---------------|
| LRB5608 | 1.5 | 47104 |
| LRB5710 | 1.0 | 38912 |
| LRB5809 | 1.5 | 45056 |
| LRB5506 | 1.75 | 40960 |
| LRB5609 | 1.25 | 45056 |
| LRB5905 | .75 | 47104 |
| LRB5512 | 1.75 | 38912 |
| LRB6005 | 2.75 | 63488 |
| LRB6207 | .25 | 36864 |
| LRB6206 | .25 | 36864 |
| LRB6012 | .5 | 51200 |
| LRB5706 | 1.5 | 61440 |
| LRB5707 | 1.0 | 51200 |
| LRB5606 | .75 | 47104 |
| LRB5904 | 3.0 | 45056 |
| LRB5611 | 1.0 | 36864 |
| LRB5805 | 1.5 | 53248 |
| LRB6004 | 1.25 | 53248 |
| LRB6104 | .75 | 61440 |
| LRB5207 | 1.25 | 53248 |
| LRB5307 | 1.25 | 38912 |
| LRB5407 | .75 | 36864 |
| LRB6305 | 1.25 | 45056 |
| LRB6306 | 2.0 | 71680 |
| LRB6308 | 2.0 | 59392 |
| LRB6309 | 2.0 | 47104 |
| LRB6310 | .75 | 34816 |
| LRB6312 | 1.0 | 53248 |
| LRB6411 | 1.25 | 55296 |
| LRB6410 | 2.0 | 59392 |
| LRB6511 | 1.25 | 57344 |
| LRB6512 | 1.25 | 49152 |
| LRB5507 | 3.5 | 65536 |
| AVERAGE | 1.5 | 50088 |

* TIME IN HOURS, DISC SPACE IN BYTES

CHAPTER XIII. RIVER REACH INFORMATION COVERAGE

XIII. RIVER REACH INFORMATION COVERAGE

The River Reach Information (RVR) coverage contains information collected for the Shoreline Inventory Data Base developed at VIMS in the mid to late 70's, and updated in 1985. The data base houses information on shoreline type, usage, condition, stability, and stabilization structures on a reach by reach basis. An eight digit code identifies a reach based on water body, county, and reach number. Attribute tables store data for each reach and can be linked with the reach identification number using a code called REACHCODE. Reach locations/codes are digitized and plotted on the LRB, 1:100,000 shoreline coverage (ref. Chapter 12). Methodologies for data collection and analysis are referenced in the Shoreline Situation Reports (Byrne et al. 1976-1978) published by county at the Virginia Institute of Marine Science, or in Shoreline Erosion in Tidewater Virginia (Byrne and Anderson, 1985), also published at VIMS. A folio of the river reach stations is included in this section. For publication purposes, maps are represented at a scale of 1:68,000. Documentation on this coverage follows.

GEOGRAPHIC DATA SET DESCRIPTION

VIMS GIS Lab Prefix RVR

Data Layer Name RIVER REACH INFORMATION

Description THIS INFORMATION COMES FROM THE VIMS SHORELINE

INVENTORY DATA BASE. IT CONTAINS INFORMATION ON SHORELINE REACHES.

Year(s) Collected 1975 - 1985

Base Maps used for Digitizing USGS HYDROGRAPHY DIGITAL LINE GRAPH (DLG)

Digitizing Scale 1:100000

Geographic Extent MOST OF COASTAL VIRGINIA

How Collected (Describe):

ORIGINAL DATA WAS COLLECTED USING MAPS AND VERTICAL PHOTOGRAPHY FOR THE
VIMS SHORELINE SITUATION REPORTS. DATA WAS UPDATED IN 1985 WITH A VIDEO
SURVEY.

Actual/Intended Use or Purpose:

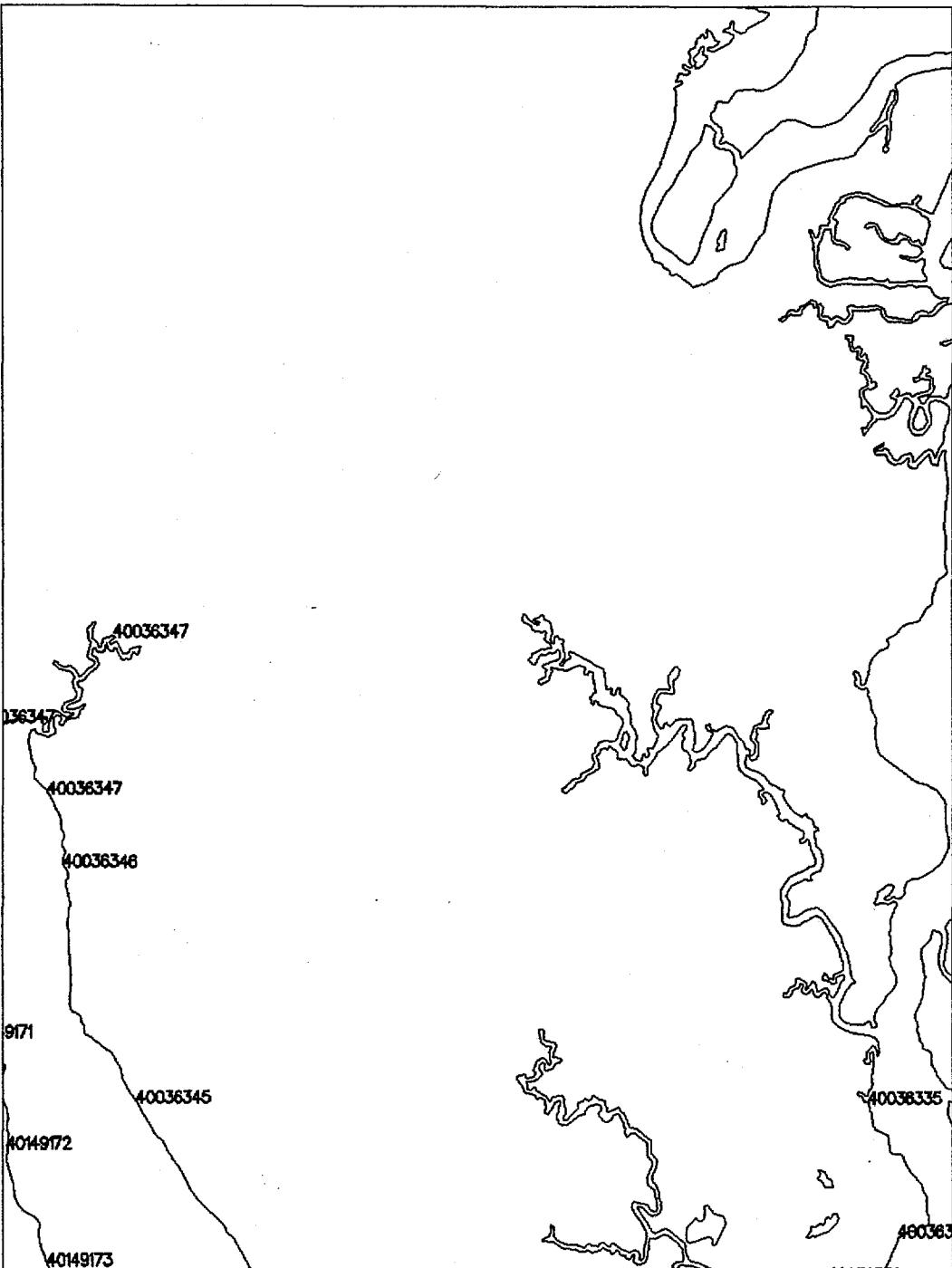
TO ANALYZE THE PHYSICAL AND GEOGRAPHICAL PROPERTIES, LAND USE PATTERNS,
AND GENERAL SHORELINE CONDITIONS ON A REACH BASIS.

VA TIDAL RIVERS INVENTORY
AVERAGE TIME AND DISC SPACE USED*
RIVER REACH COVERAGE

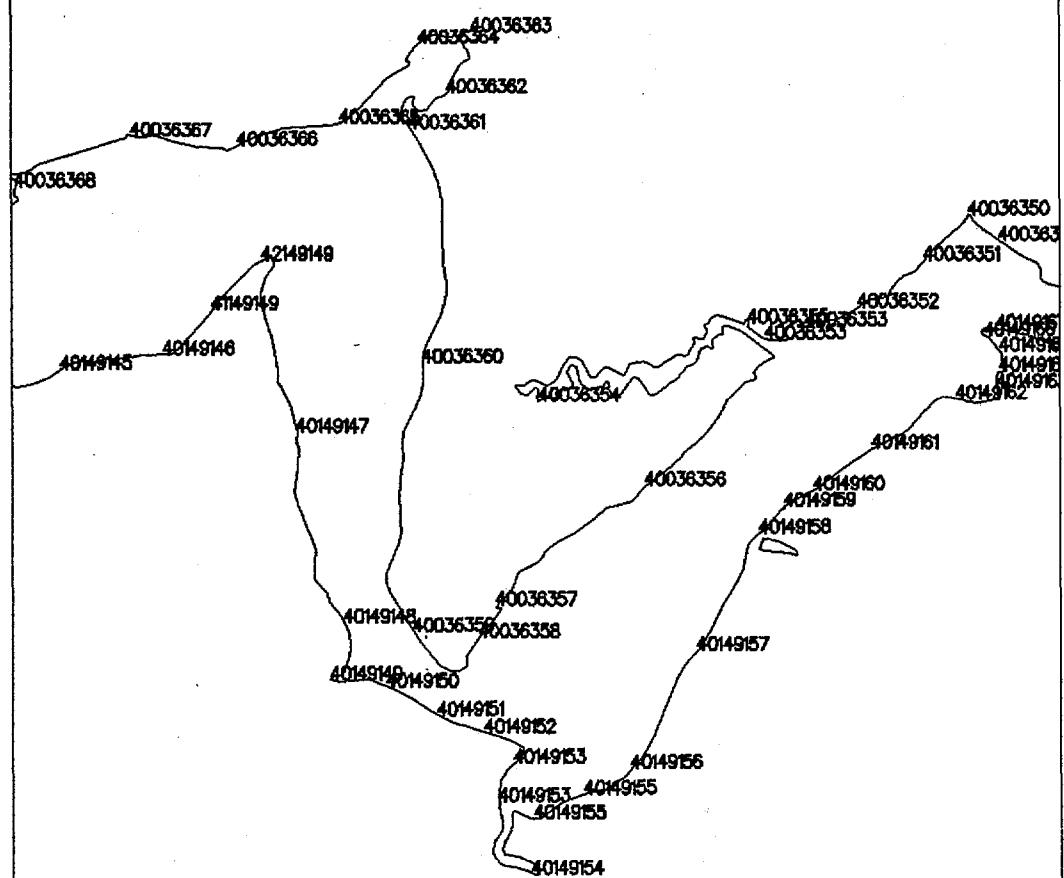
| MAP NUMBER | TIME | DISC SPACE |
|------------|------|------------|
| RVR5512 | 1.25 | 16384 |
| RVR5710 | 1.5 | 28672 |
| RVR5809 | 2.0 | 16384 |
| RVR5608 | 1.0 | 47104 |
| RVR5506 | 2.0 | 36864 |
| RVR5609 | 1.75 | 43008 |
| RVR6005 | 2.0 | 63488 |
| RVR5905 | 1.5 | 45056 |
| RVR6206 | 1.5 | 36864 |
| RVR6207 | 1.25 | 36864 |
| RVR6012 | 1.0 | 49152 |
| RVR5706 | 2.25 | 59392 |
| RVR5707 | .75 | 49152 |
| RVR5606 | 2.0 | 47104 |
| RVR5904 | 1.75 | 43008 |
| RVR5611 | 1.75 | 34816 |
| RVR5805 | 1.25 | 53248 |
| RVR6004 | 1.0 | 53284 |
| RVR6104 | .75 | 61440 |
| RVR5207 | 1.75 | 49152 |
| RVR5307 | 1.75 | 38912 |
| RVR5407 | 2.25 | 36864 |
| RVR6305 | 1.55 | 45056 |
| RVR6306 | 1.0 | 63488 |
| RVR6308 | 1.0 | 55296 |
| RVR6309 | 1.5 | 45056 |
| RVR6310 | 1.25 | 34816 |
| RVR6312 | 1.75 | 49152 |
| RVR6411 | 1.75 | 55296 |
| RVR6410 | 1.25 | 55296 |
| RVR6511 | 1.25 | 55296 |
| RVR6512 | 1.25 | 53248 |
| RVR5507 | 1.75 | 61440 |
| RVR5811 | 1.5 | 46683 |
| RVR5906 | 1.5 | 46683 |
| RVR6007 | 1.5 | 46683 |
| RVR6008 | 1.5 | 46683 |

AVERAGE | 1.5 | 46683

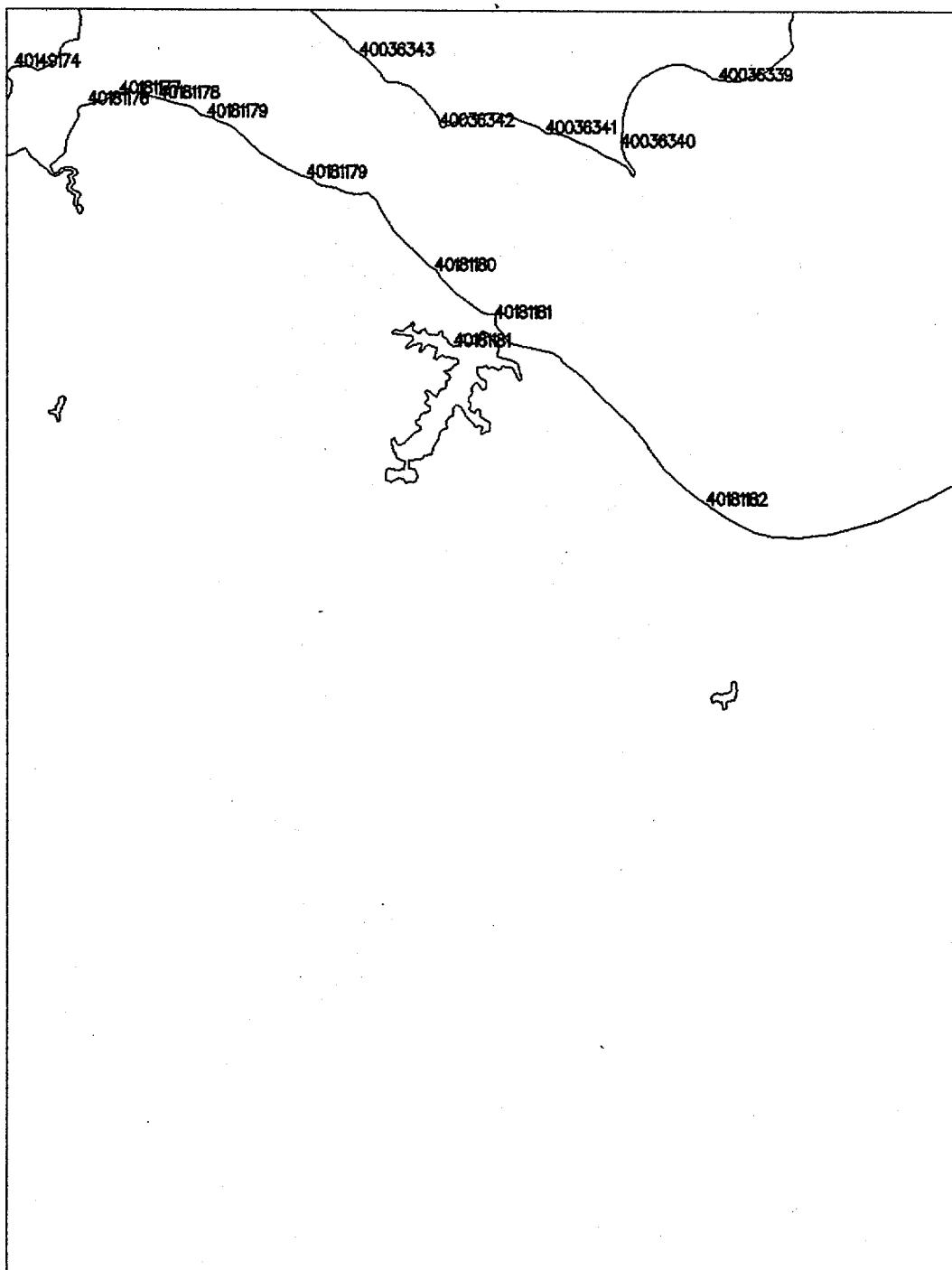
* TIME IN HOURS, DISC SPACE IN BYTES



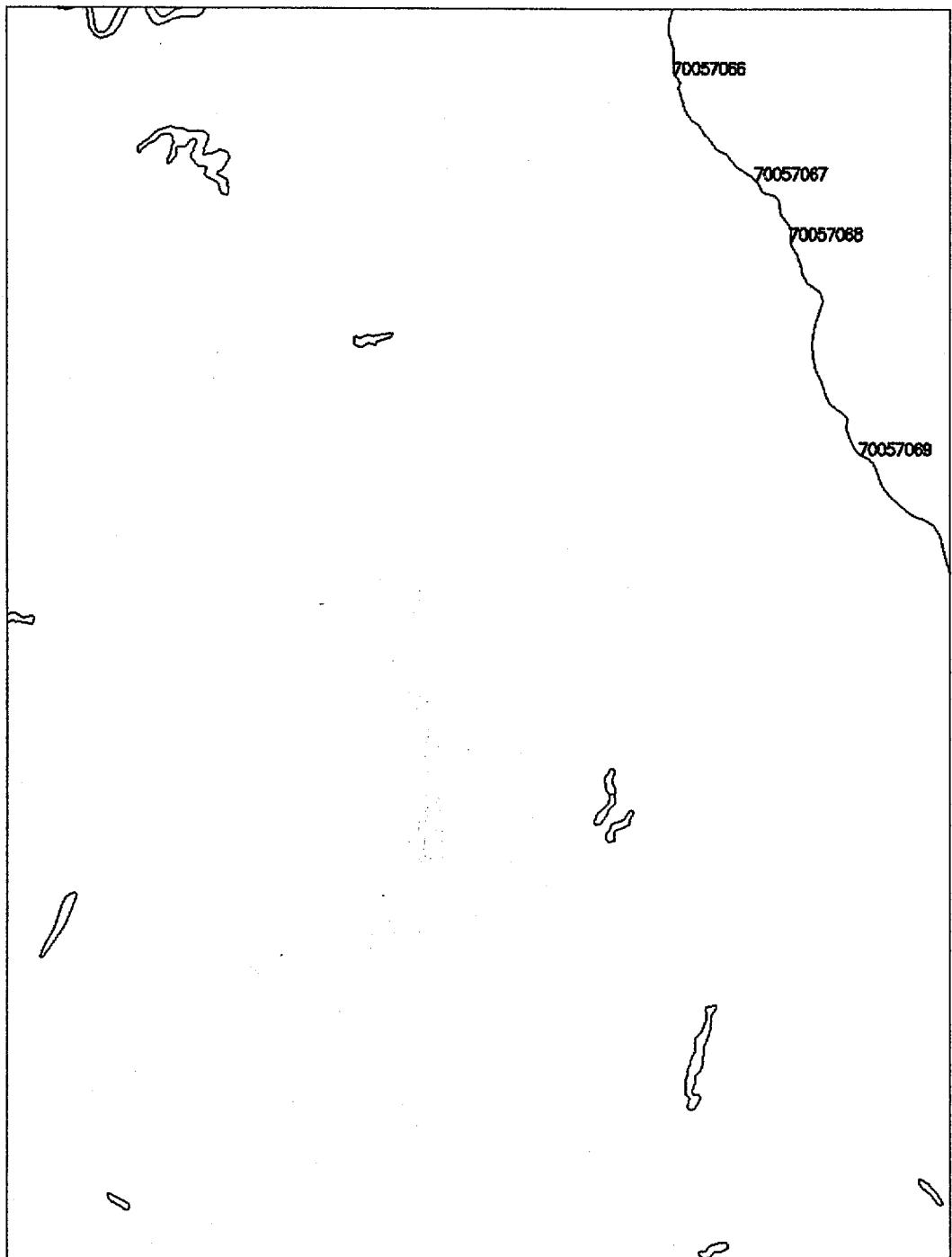
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
BRANDON QUAD



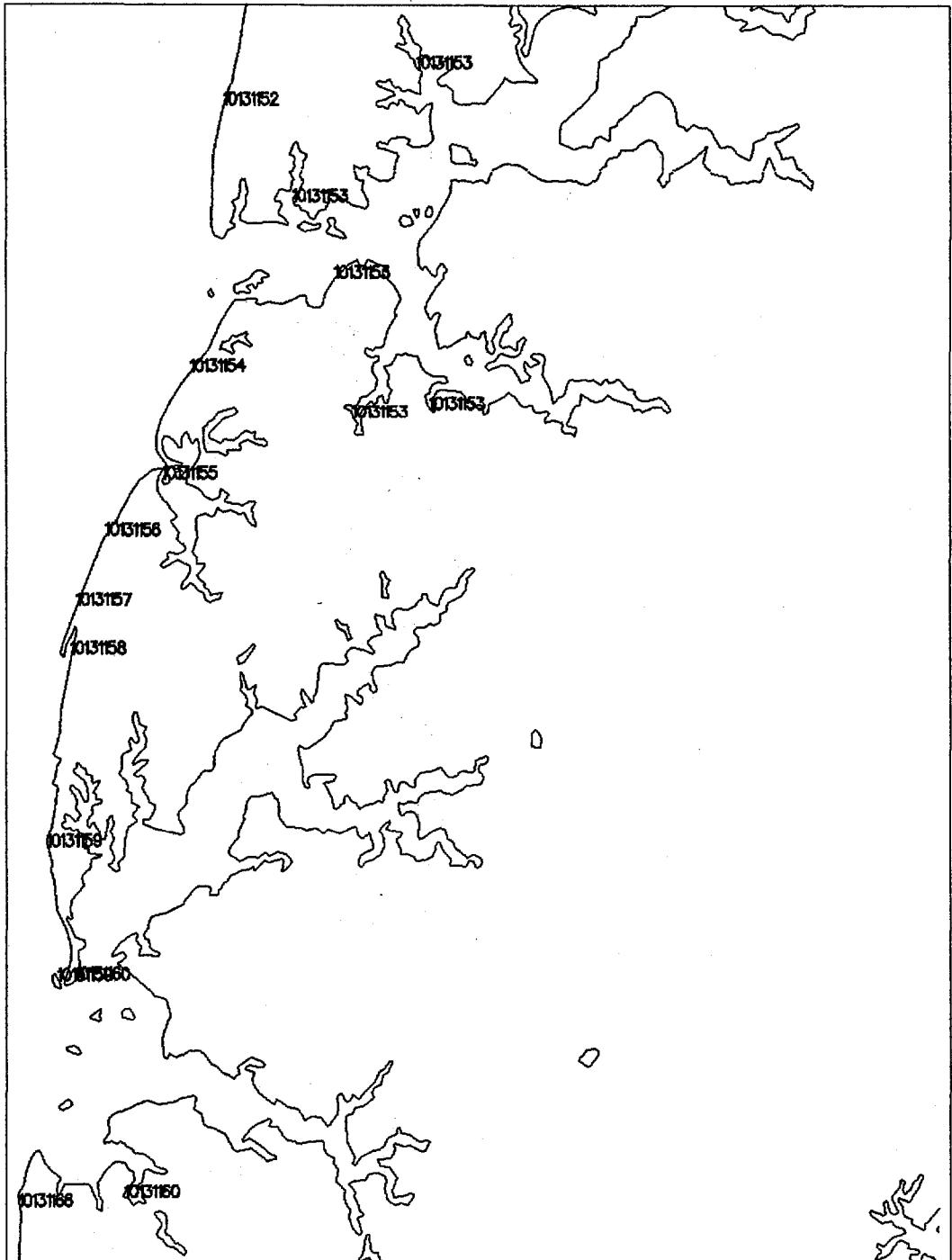
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
CHARLES CITY QUAD



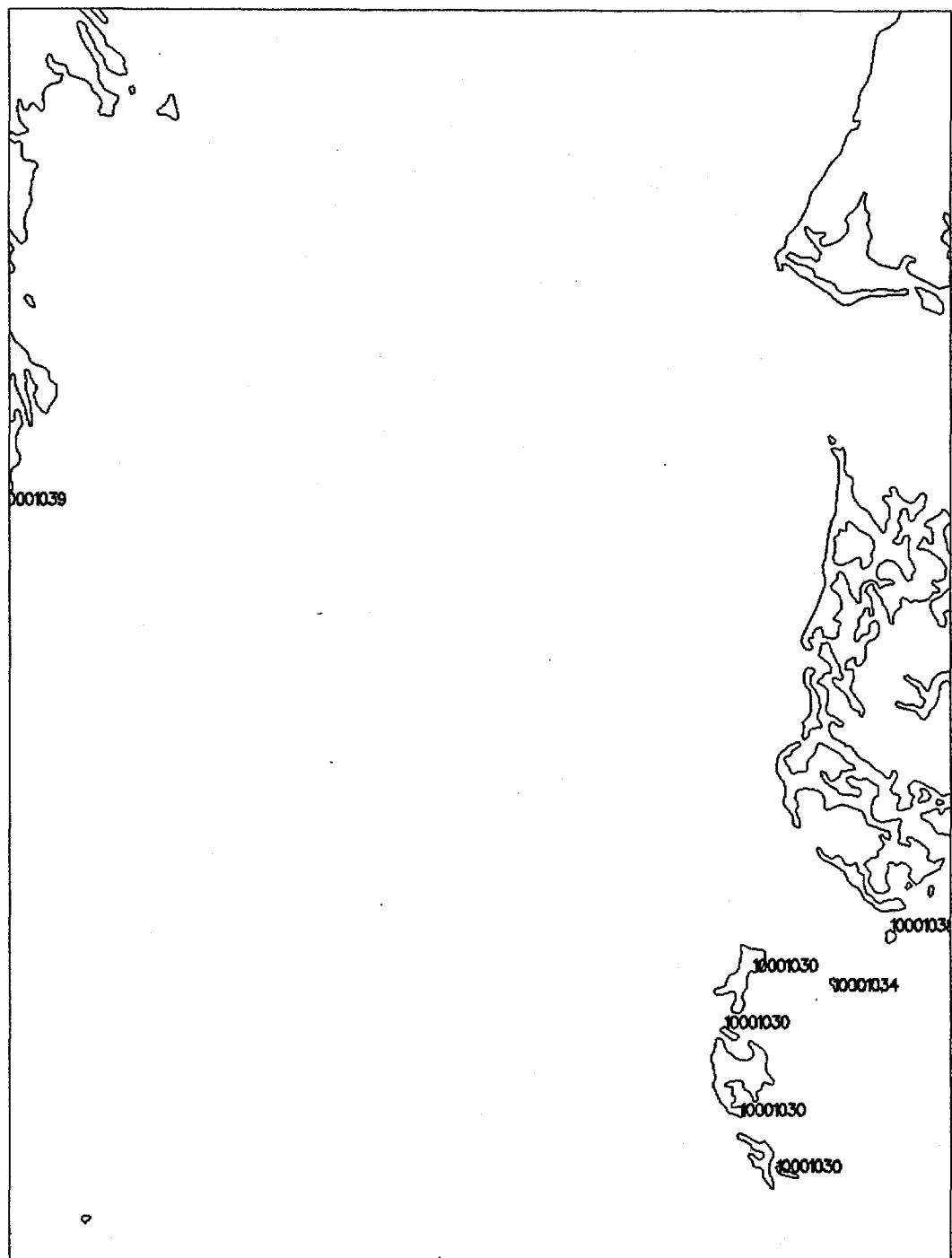
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
CLAREMONT QUAD



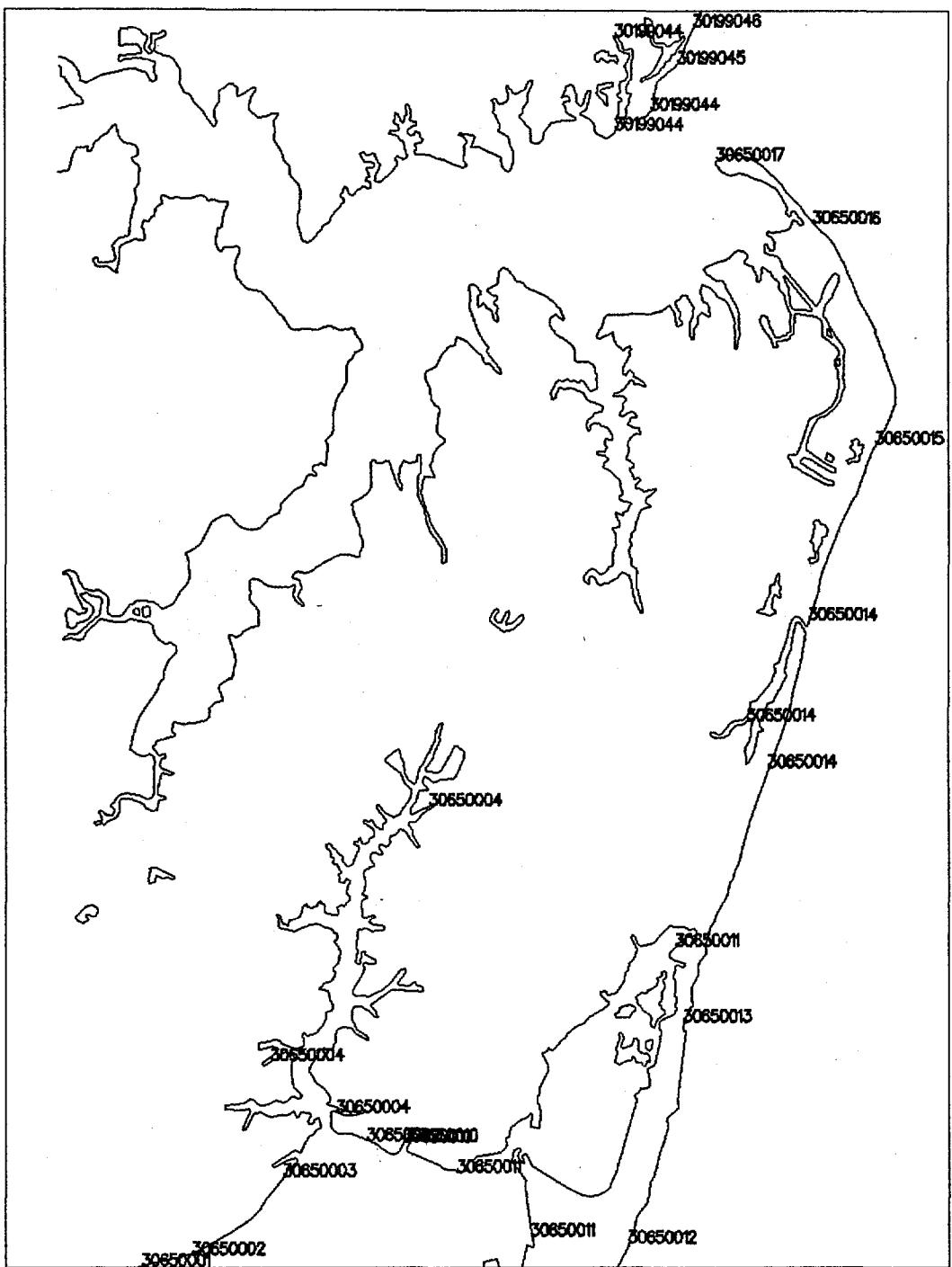
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
DUNNSVILLE QUAD



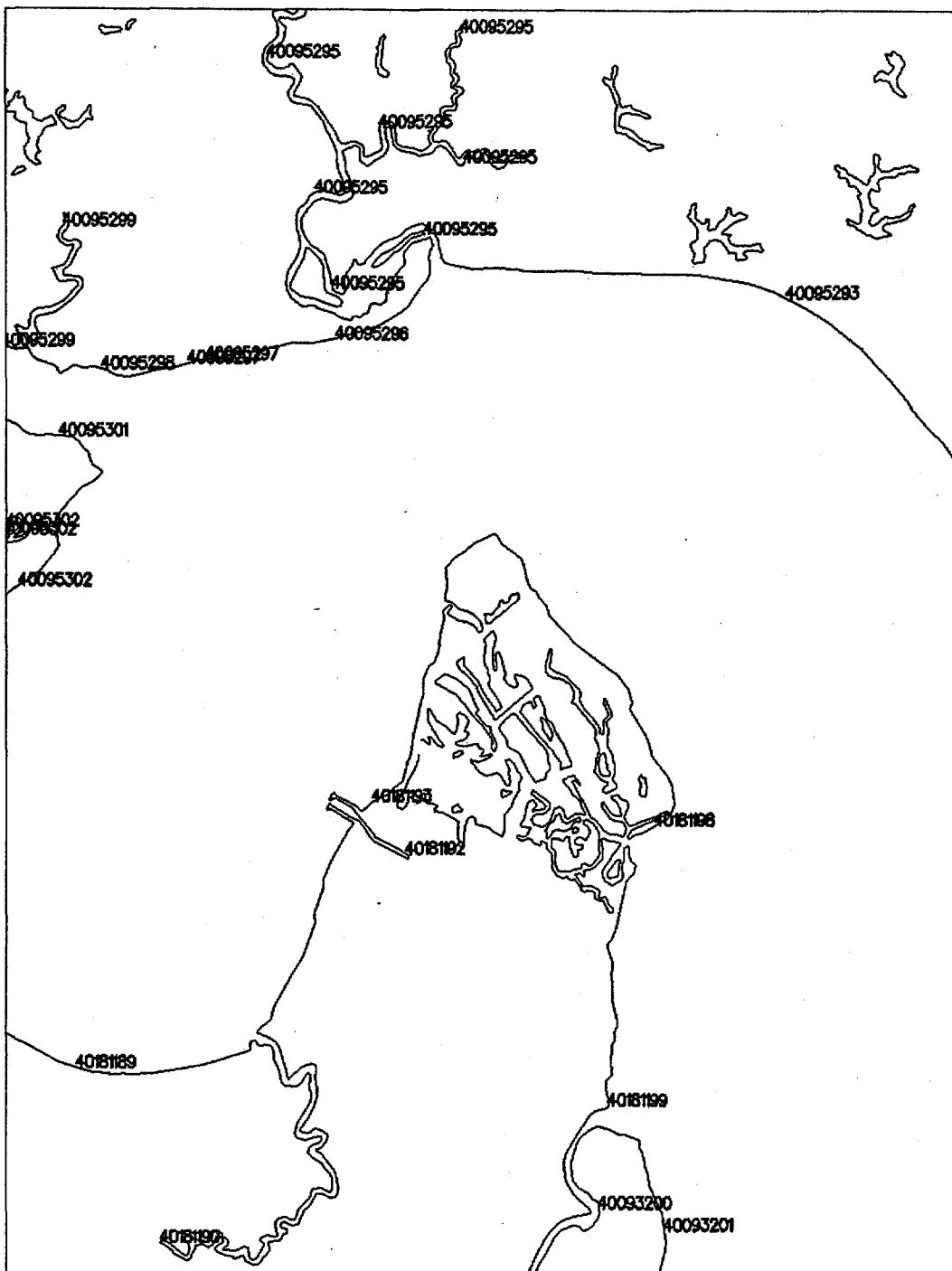
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RIVER REACH INFORMATION
REACHCODES
FRANKTOWN QUAD



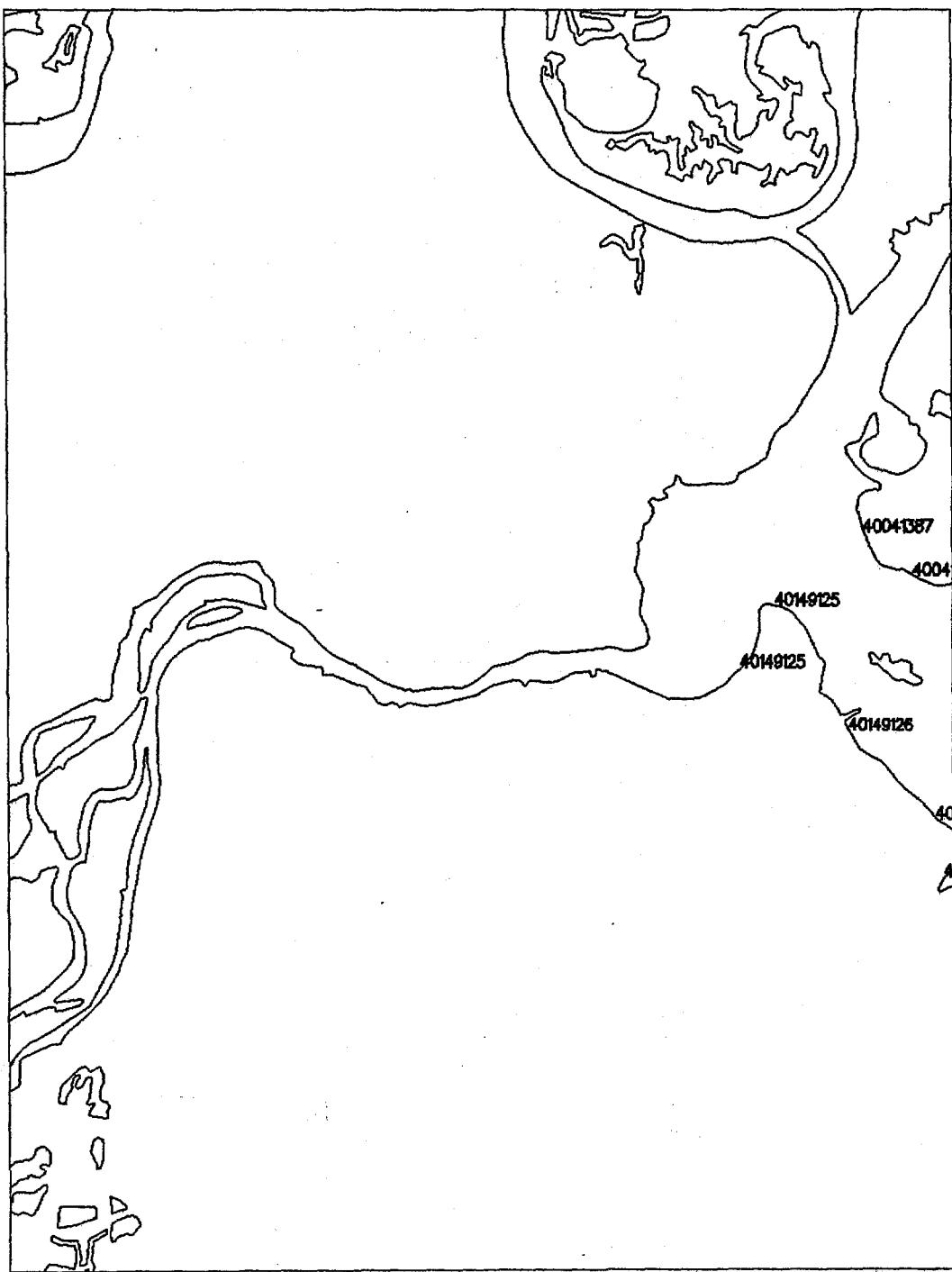
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RIVER REACH INFORMATION
REACHCODES
GREAT FOX ISLAND QUAD



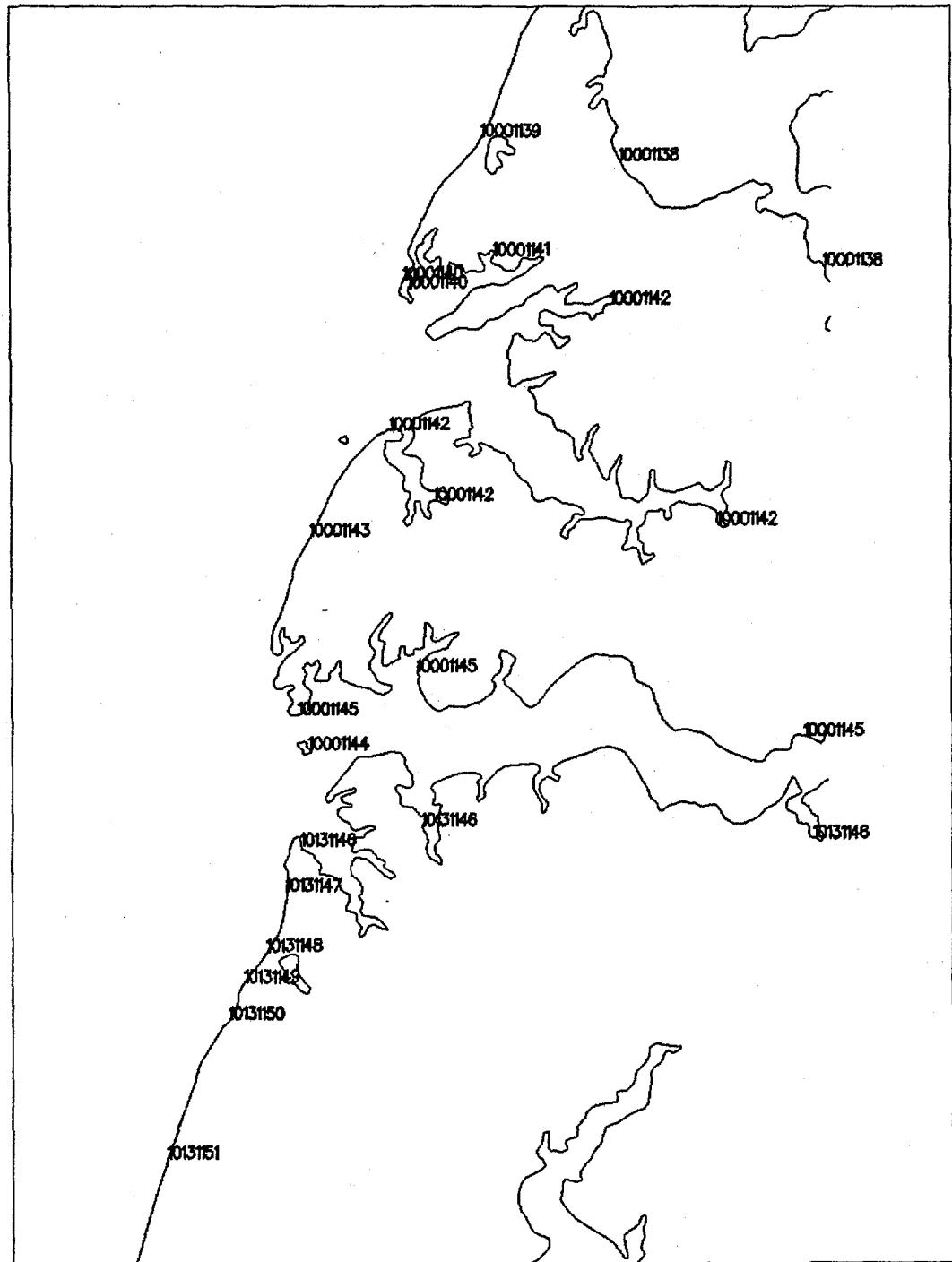
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
HAMPTON QUAD



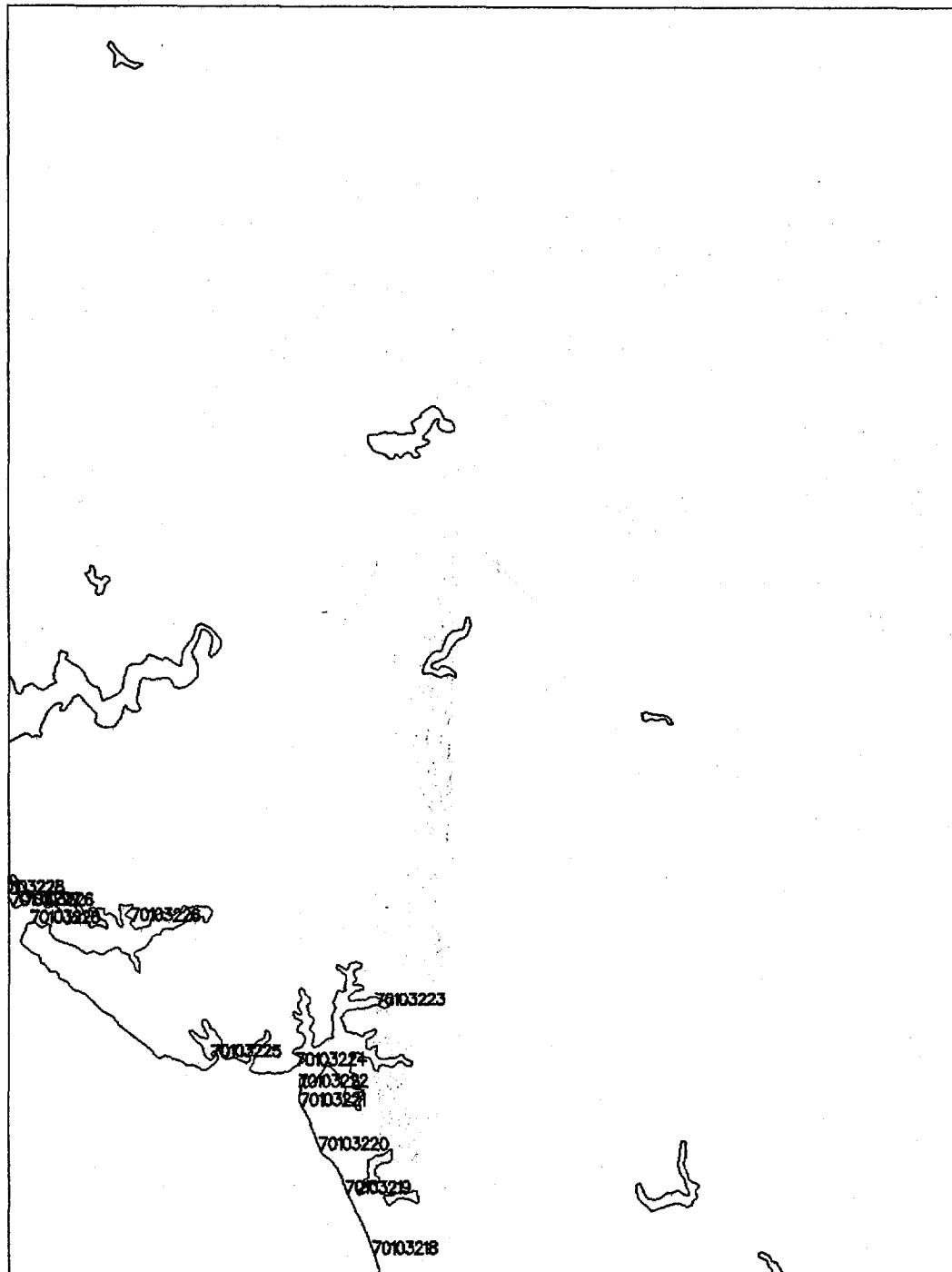
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
HOG ISLAND QUAD



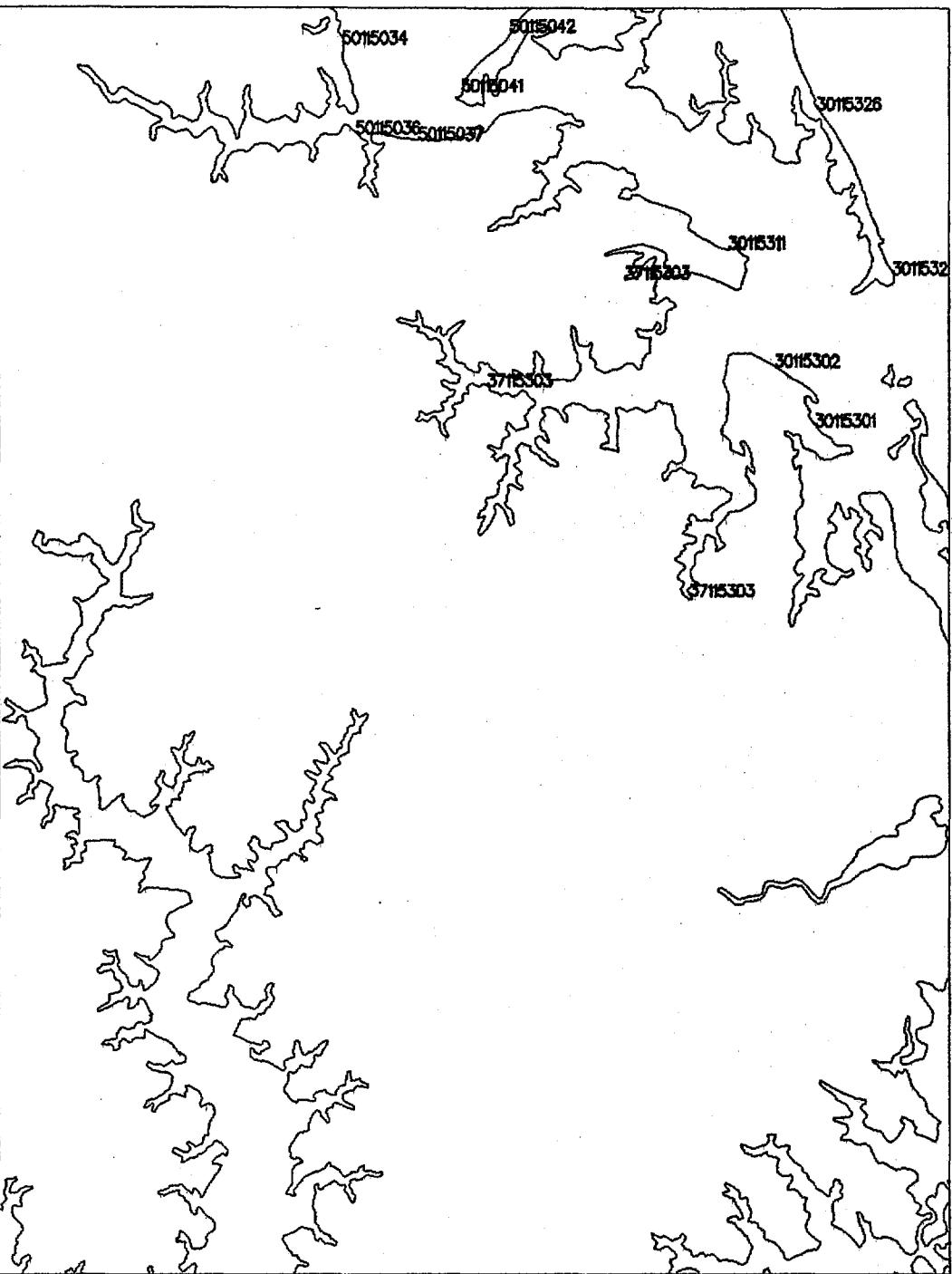
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
HOPEWELL QUAD



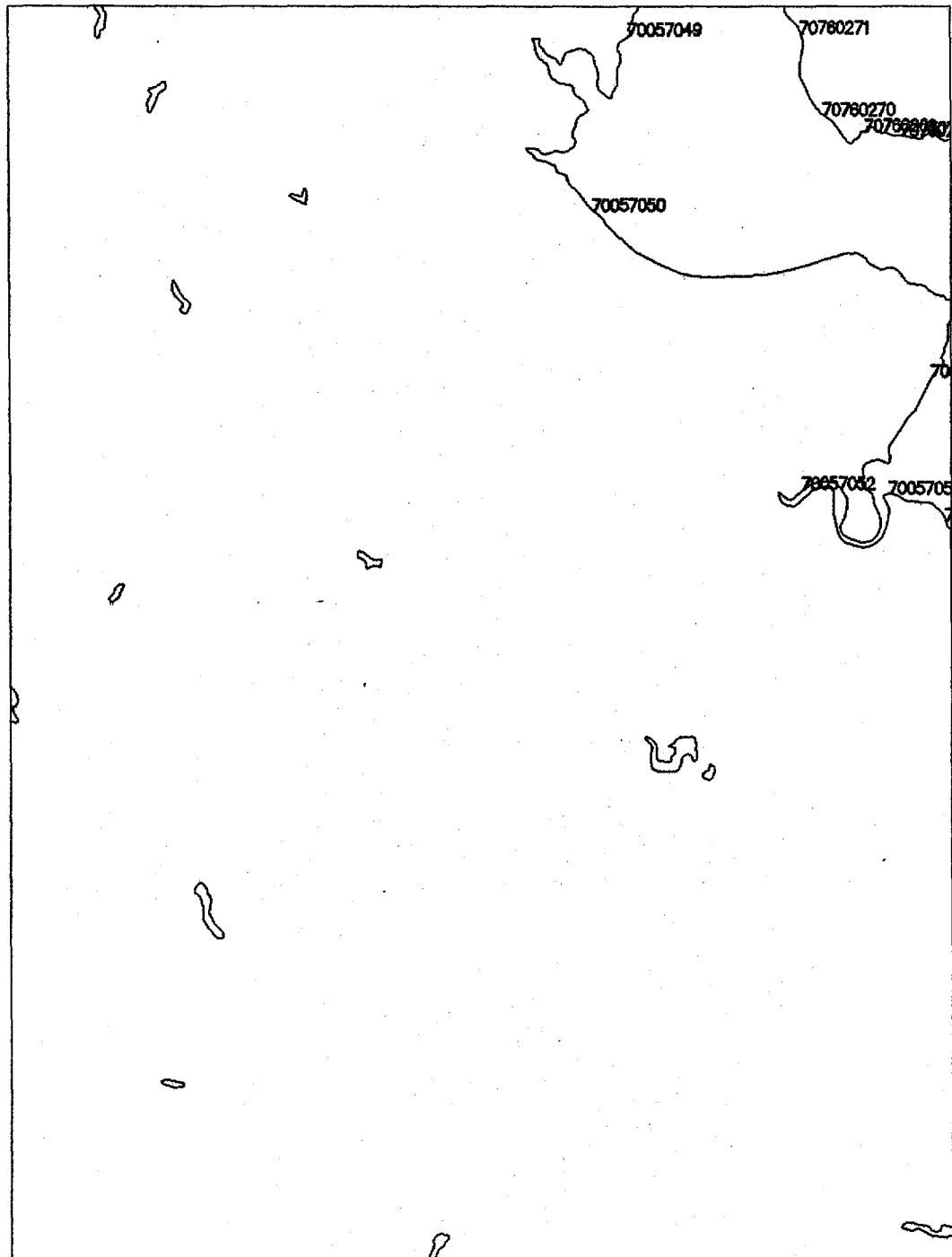
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACH CODES
JAMESVILLE QUAD



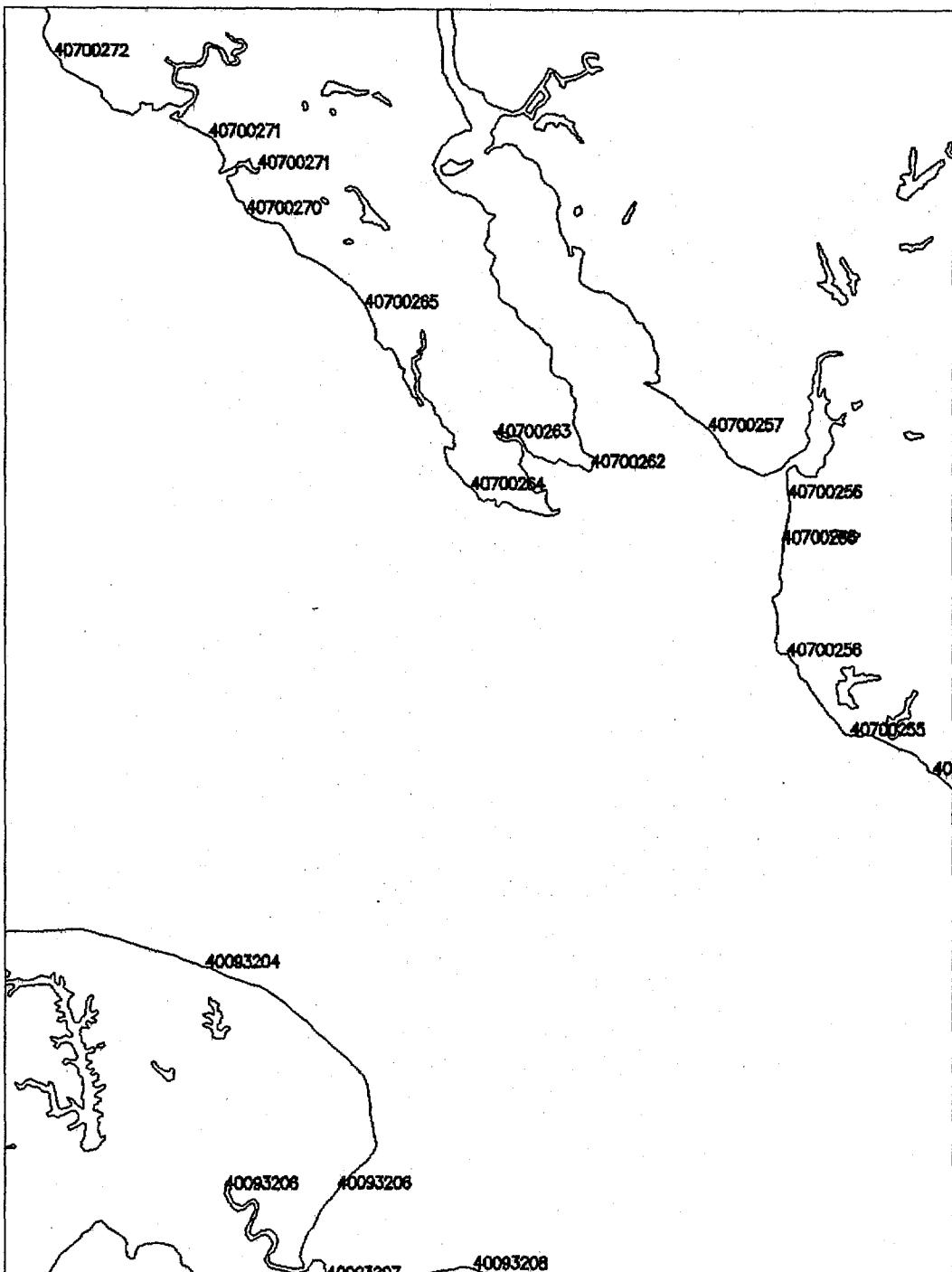
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RIVER REACH INFORMATION
REACHCODES
LIVELY QUAD



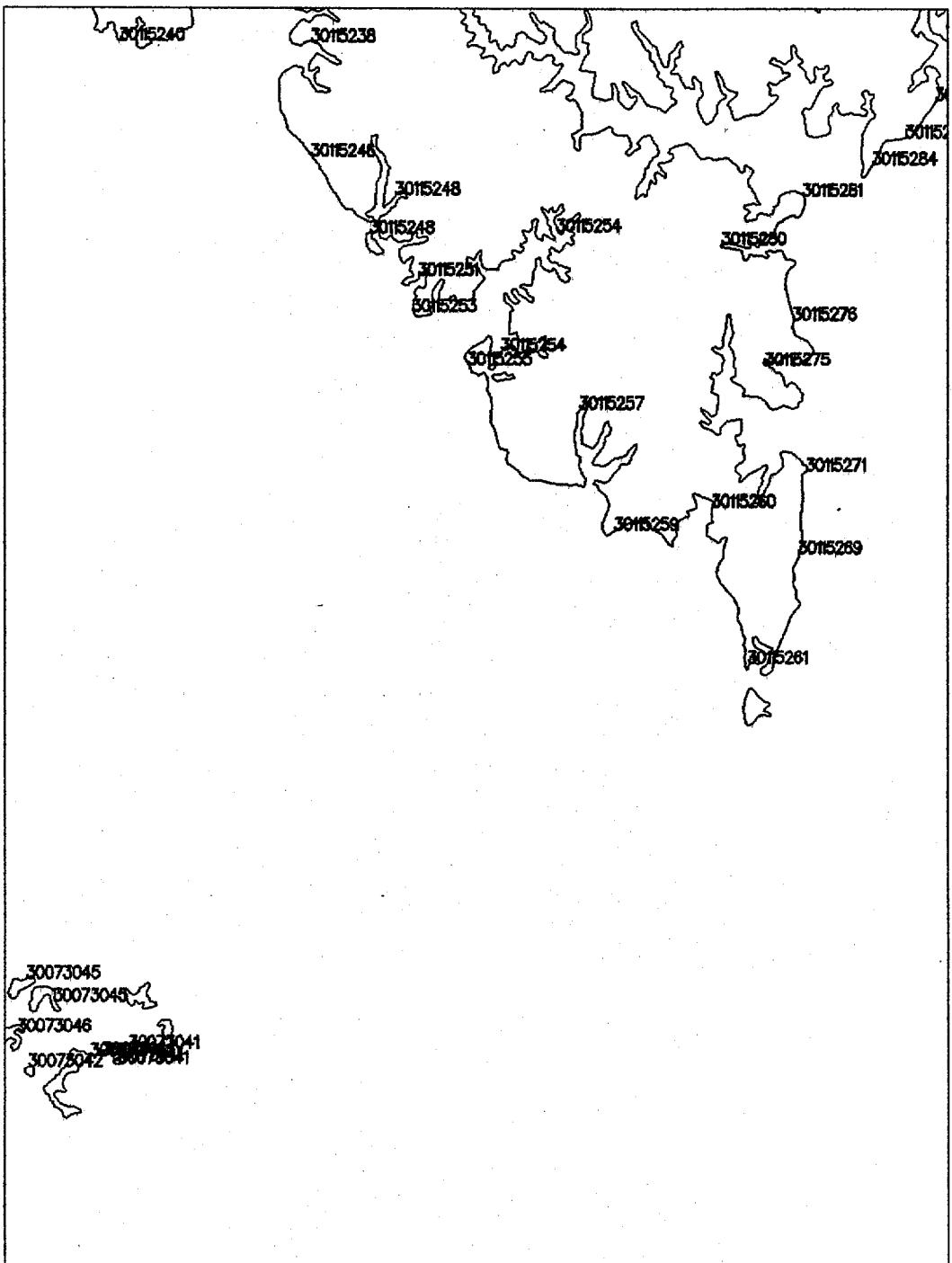
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RIVER REACH INFORMATION
REACHCODES
MATHEWS QUAD



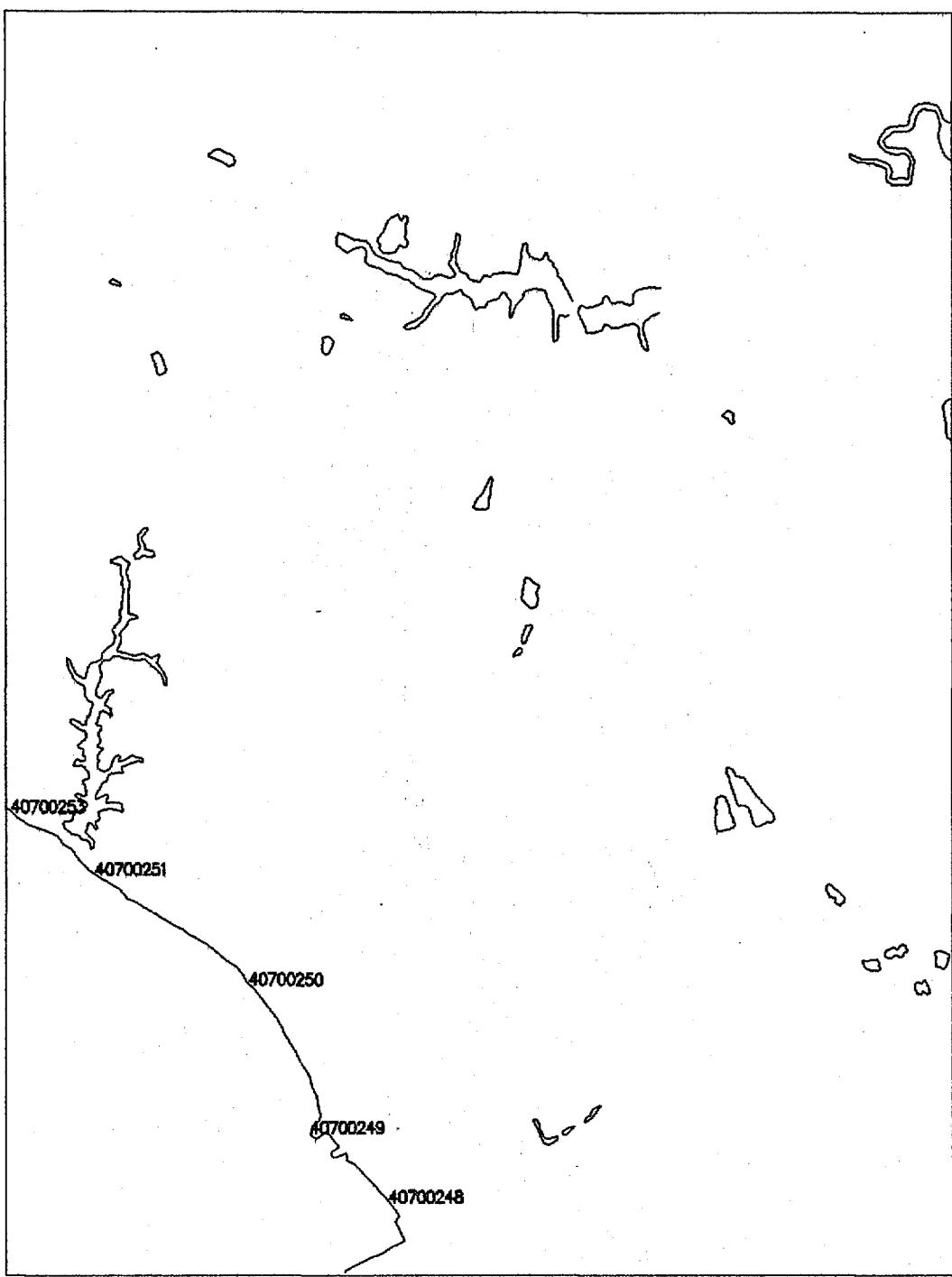
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RIVER REACH INFORMATION
REACHCODES
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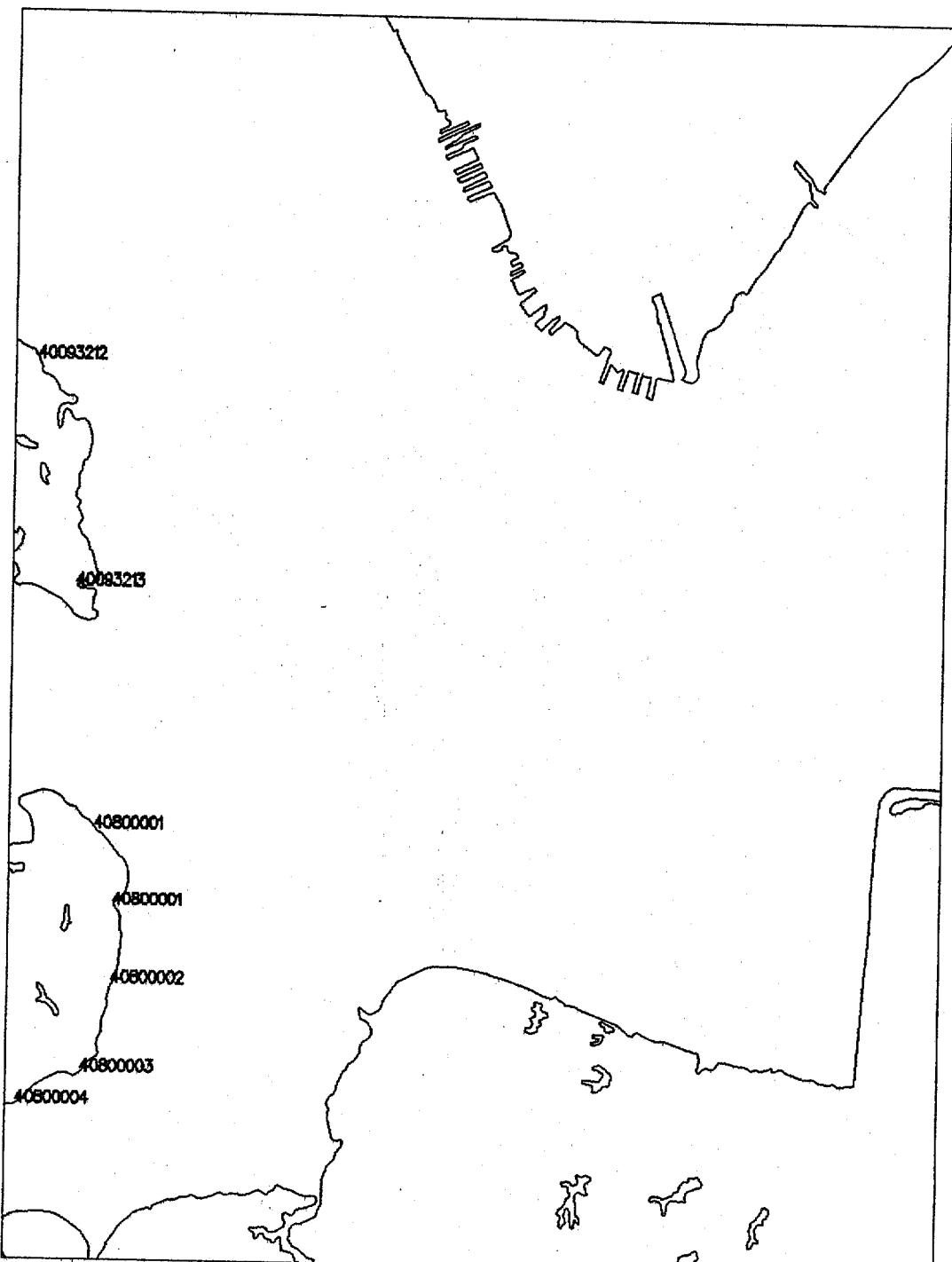
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RIVER REACH INFORMATION
REACH CODES
MULBERRY ISLAND QUAD



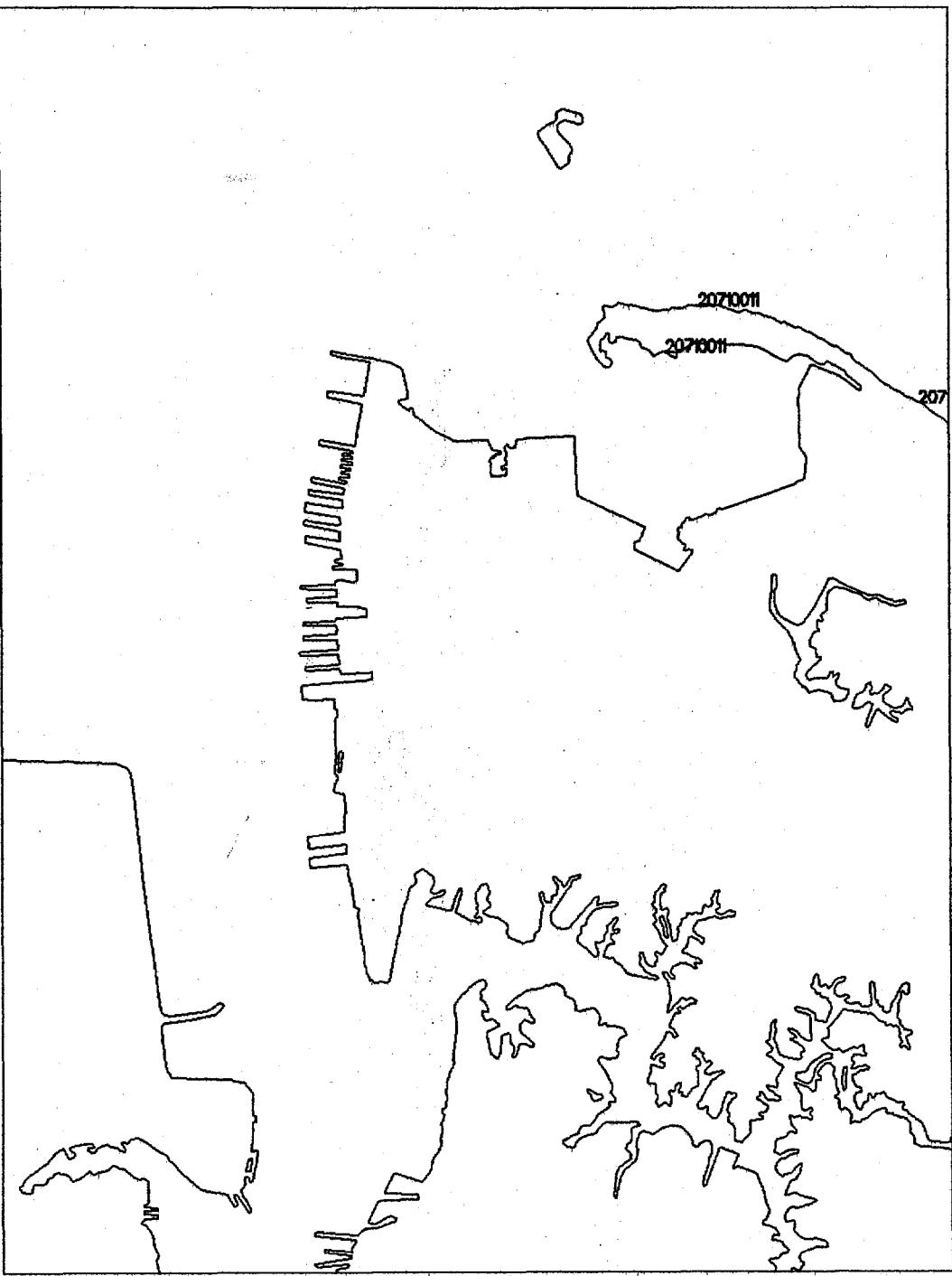
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RIVER REACH INFORMATION
REACHCODES
NEW POINT COMFORT QUAD



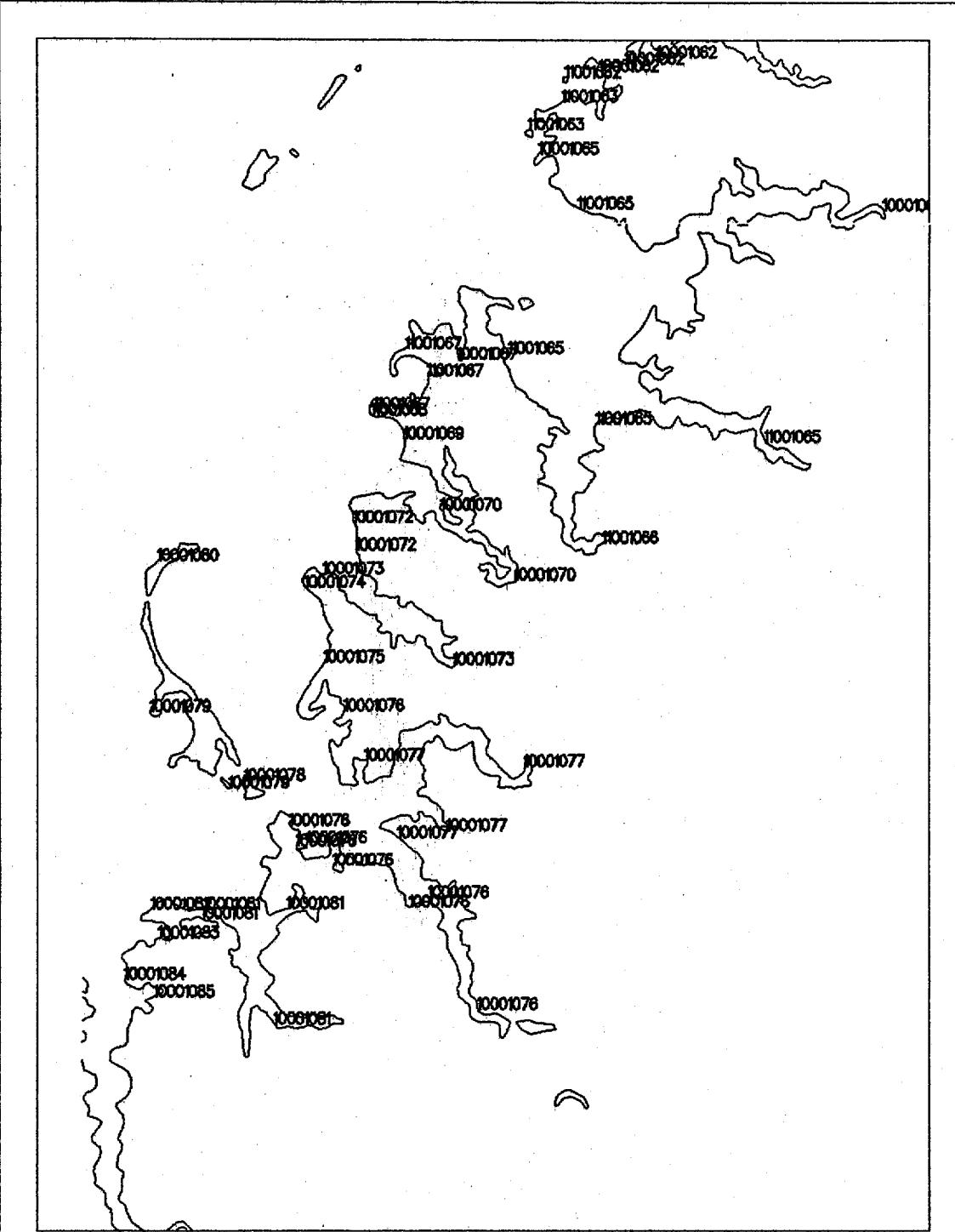
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RIVER REACH INFORMATION
REACHCODES
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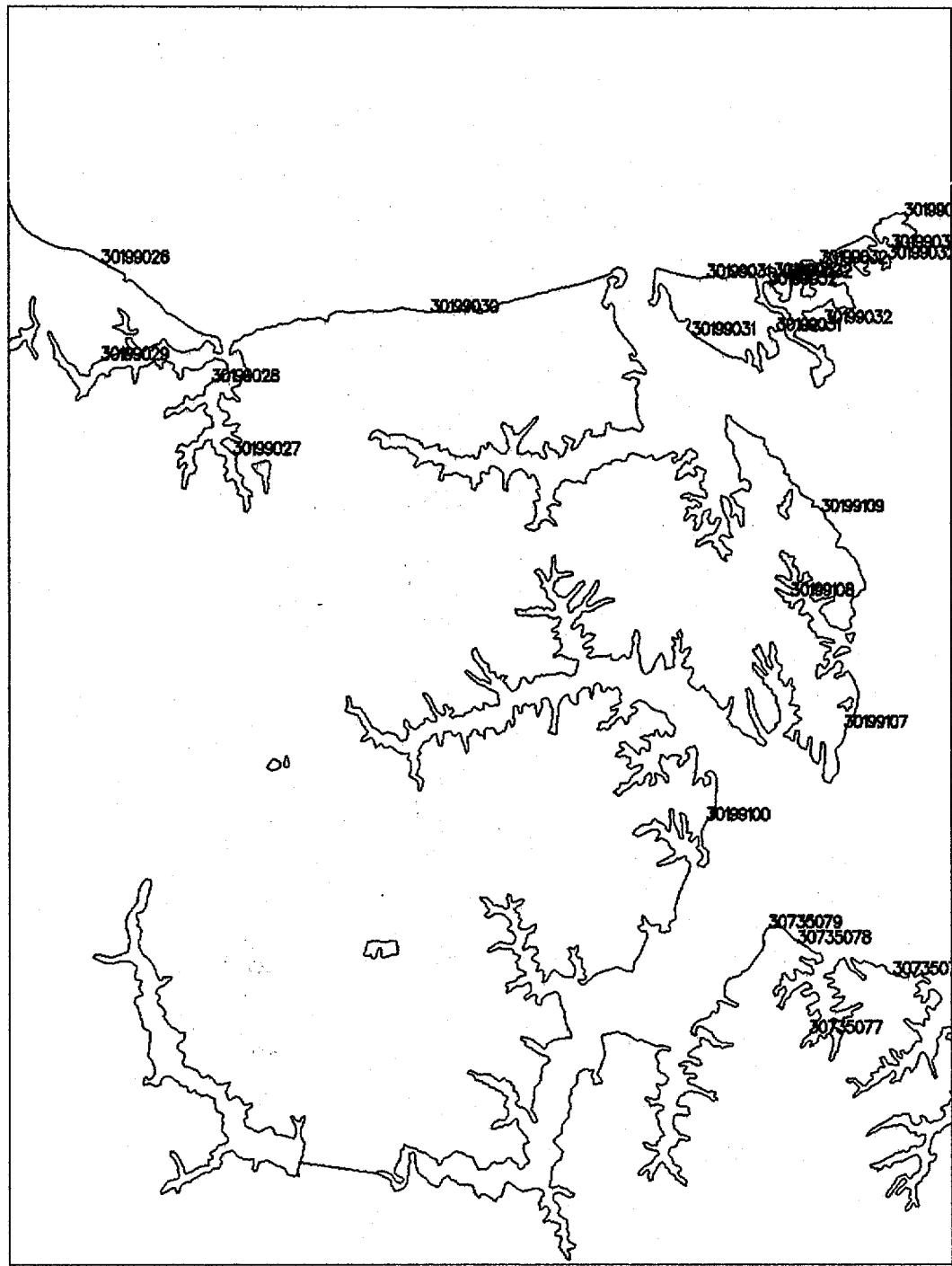
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RIVER REACH INFORMATION
REACHCODES
NEWPORT NEWS SOUTH QUAD



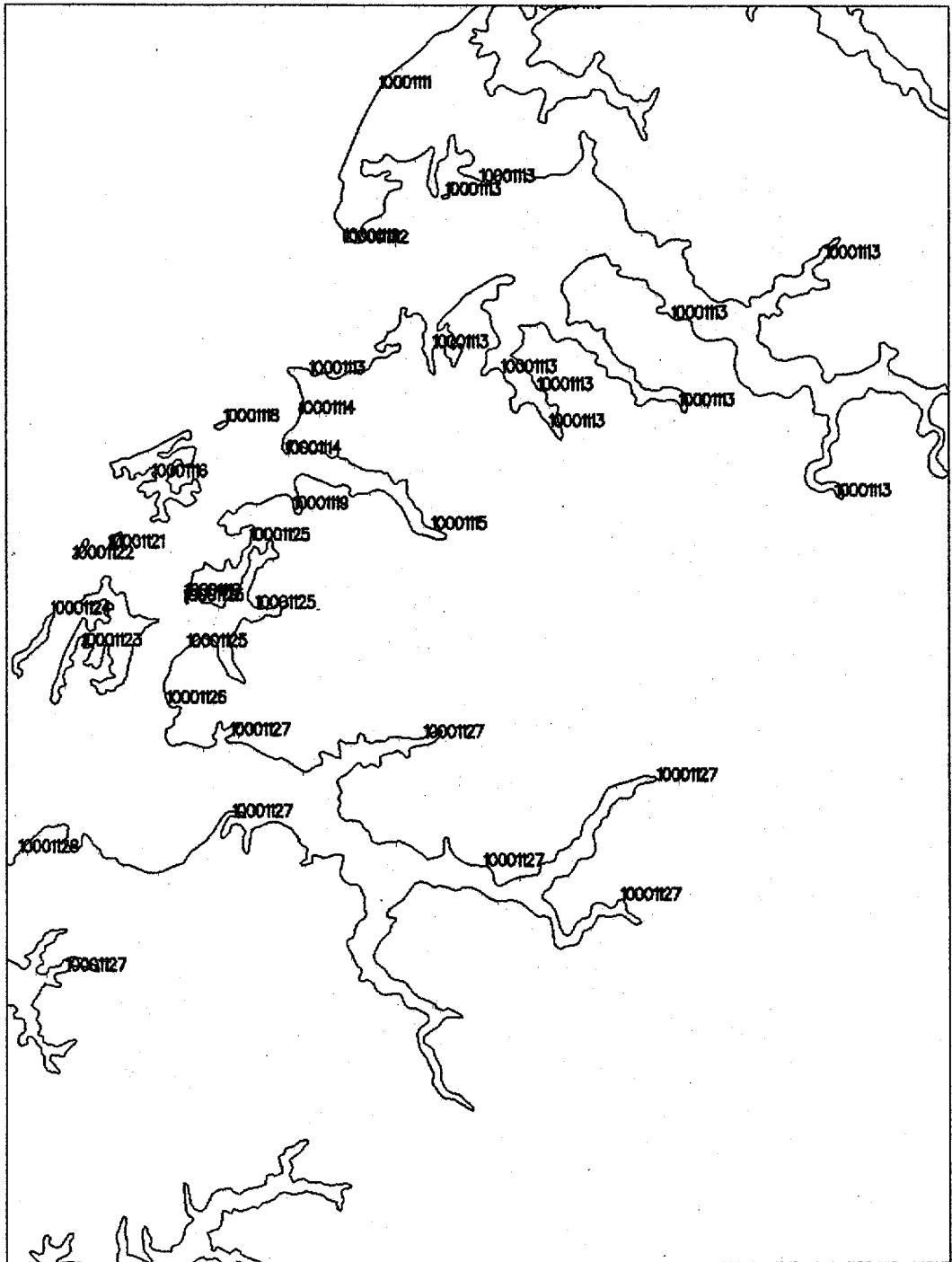
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RIVER REACH INFORMATION
REACHCODES
NORFOLK NORTH QUAD



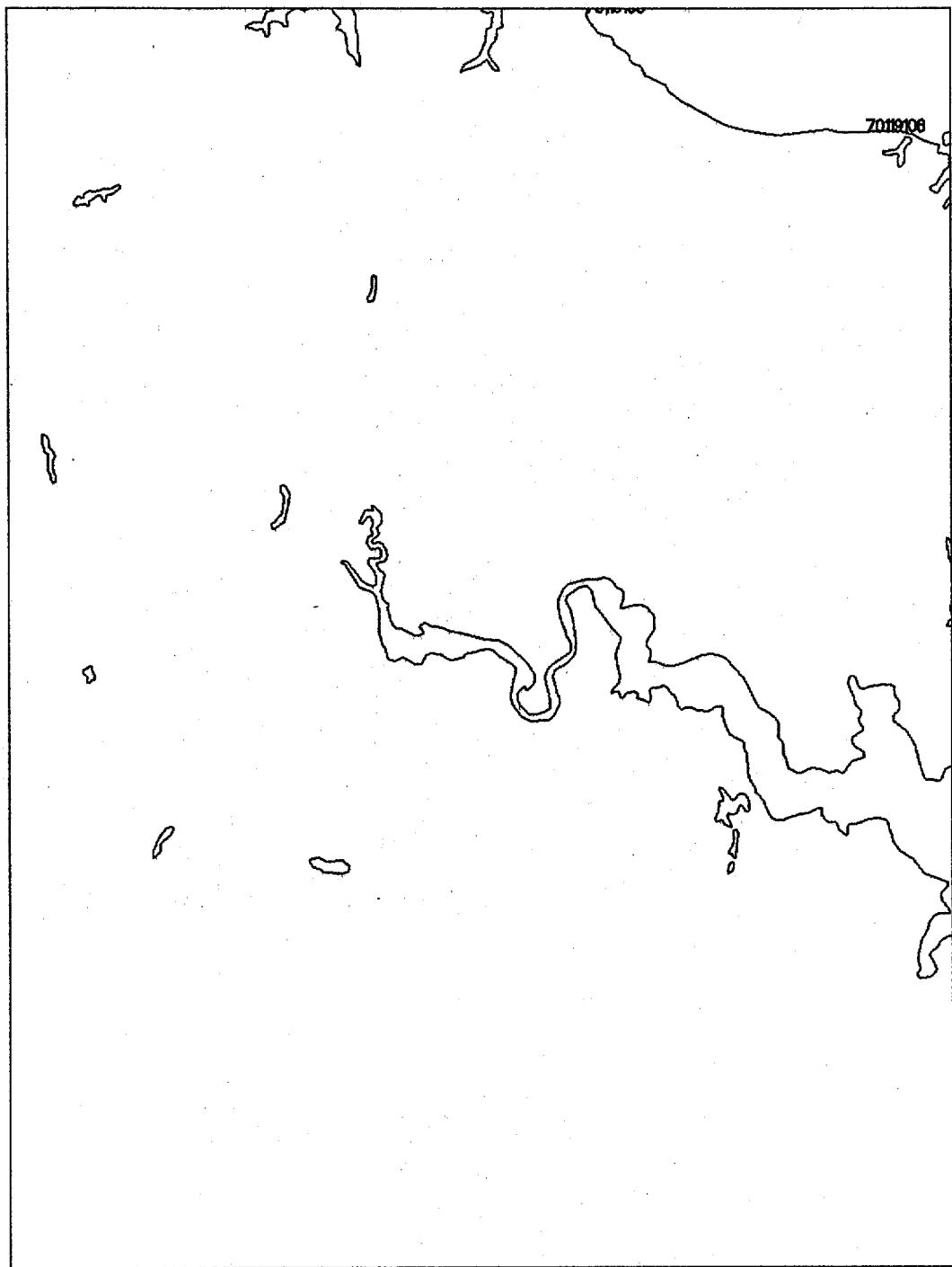
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RIVER REACH INFORMATION
REACHCODES
PARKSLEY QUAD



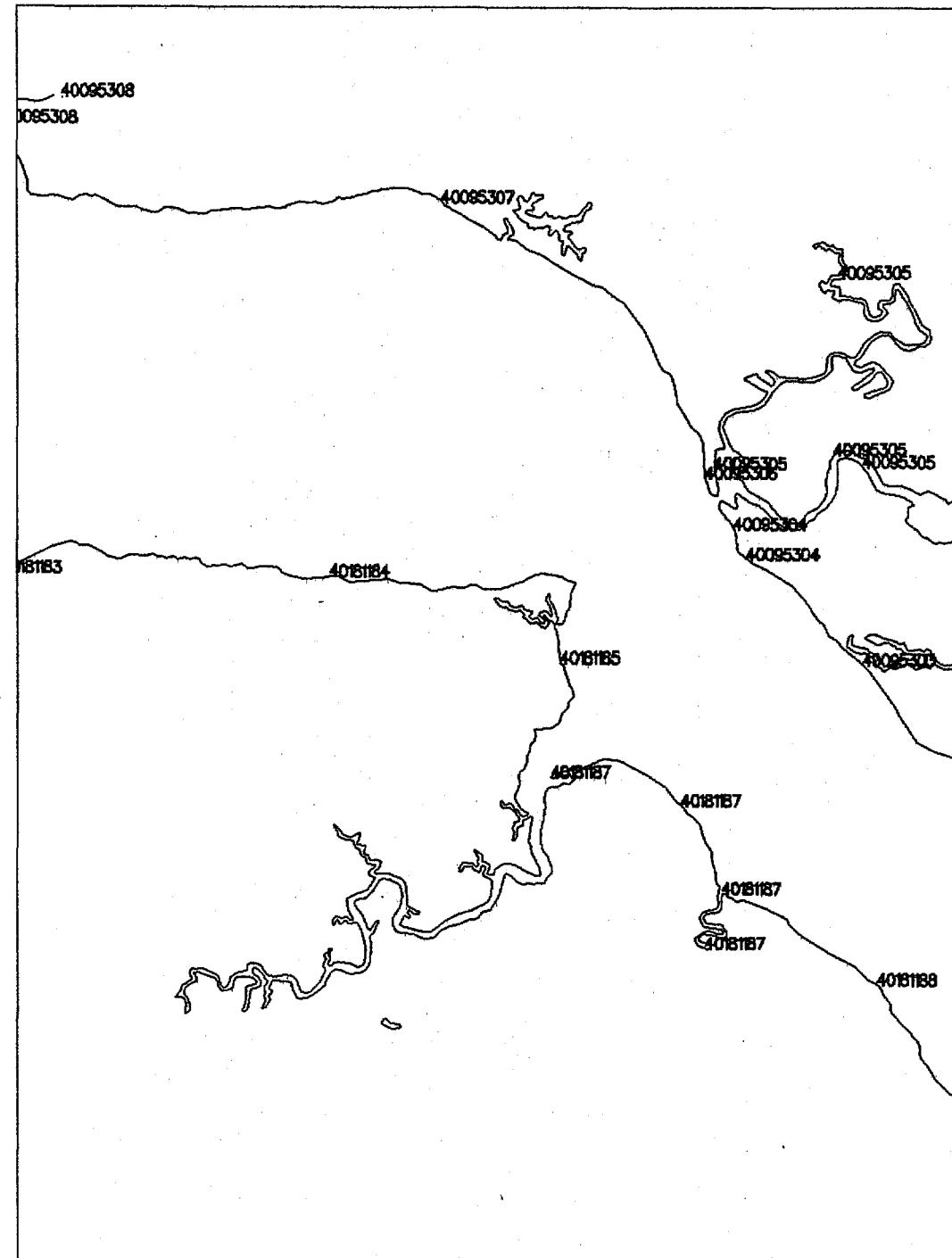
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
POQUOSON WEST QUAD



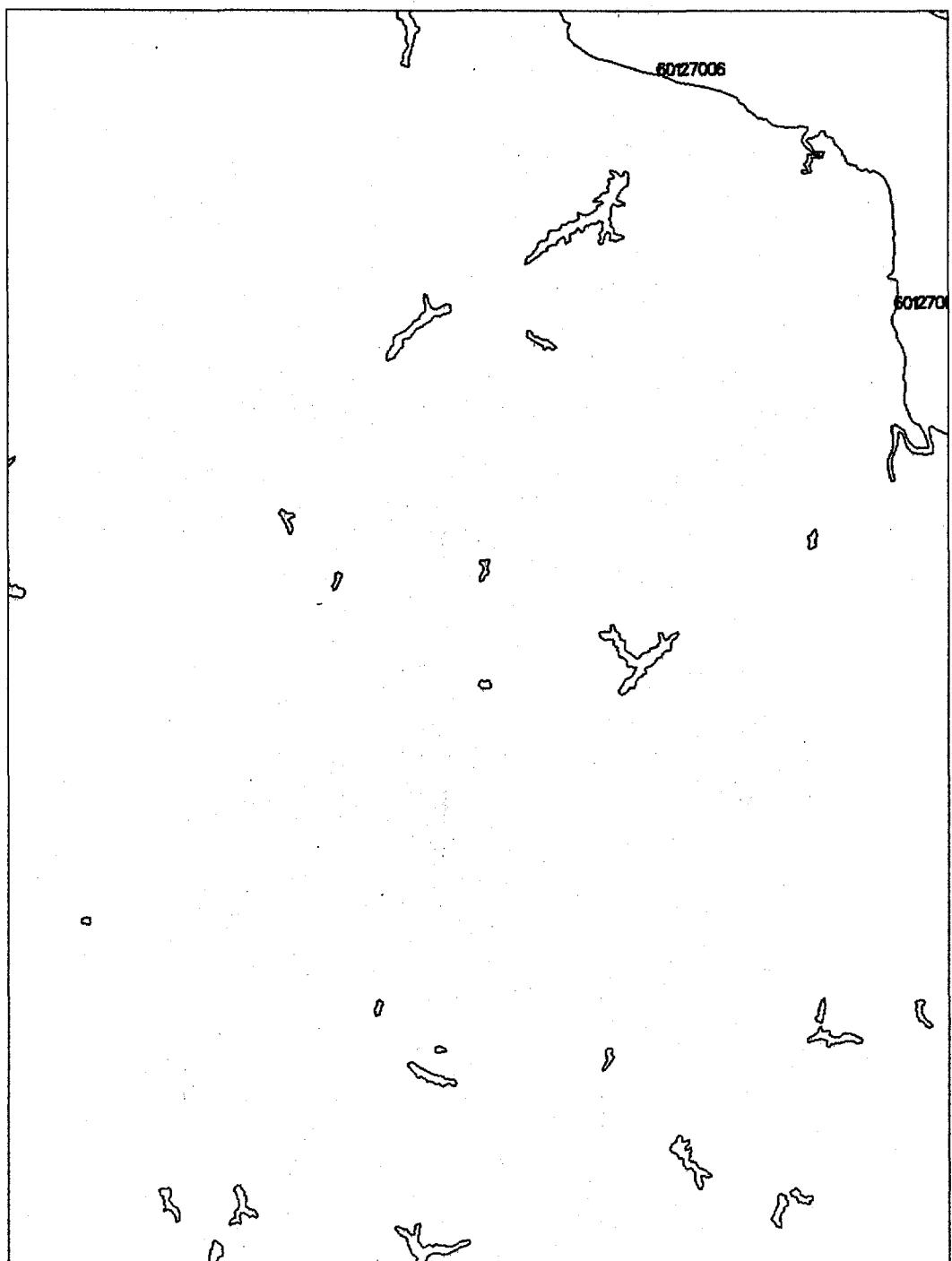
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
PUNGOTEAGUE QUAD



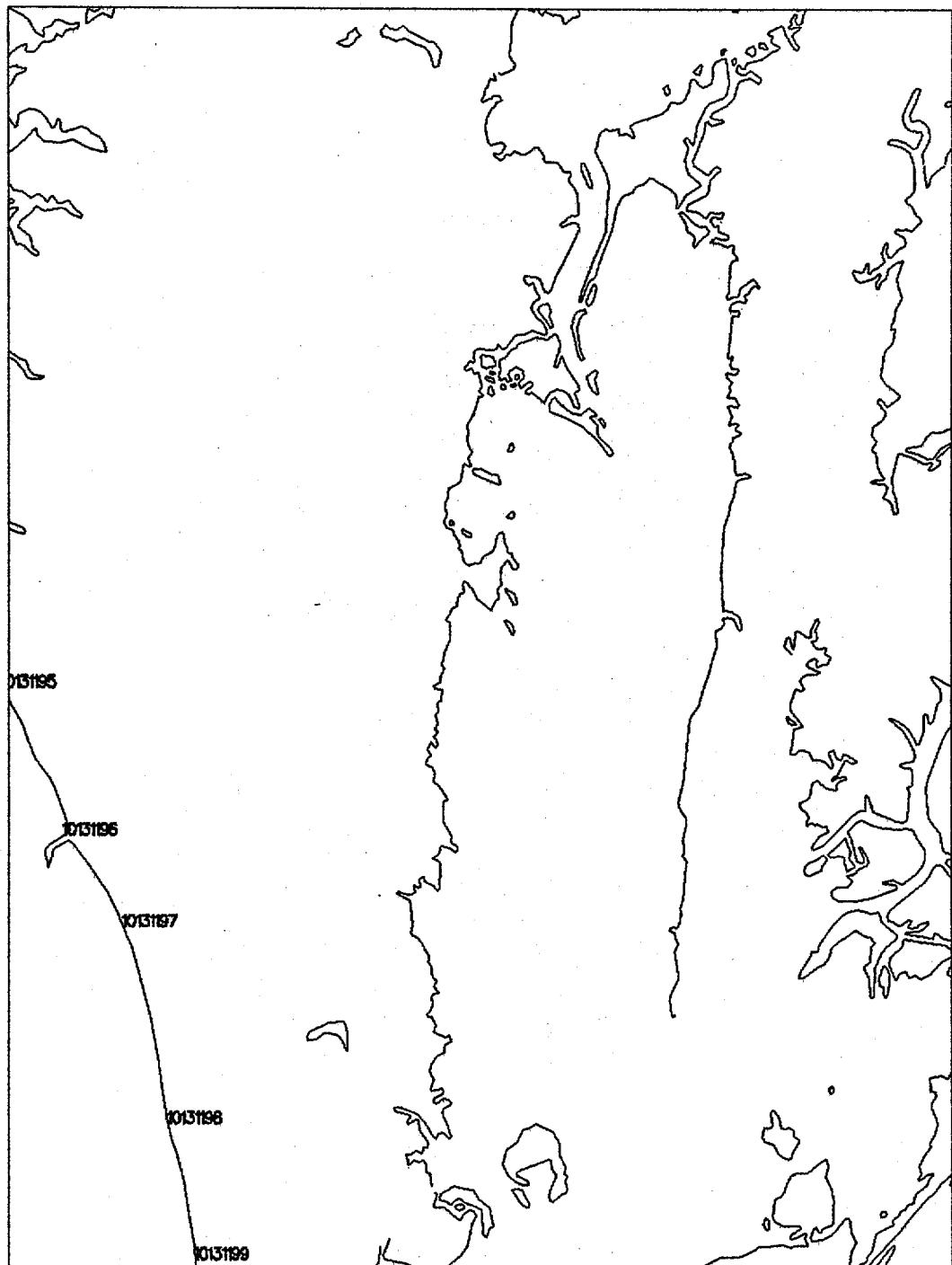
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
SALUDA QUAD



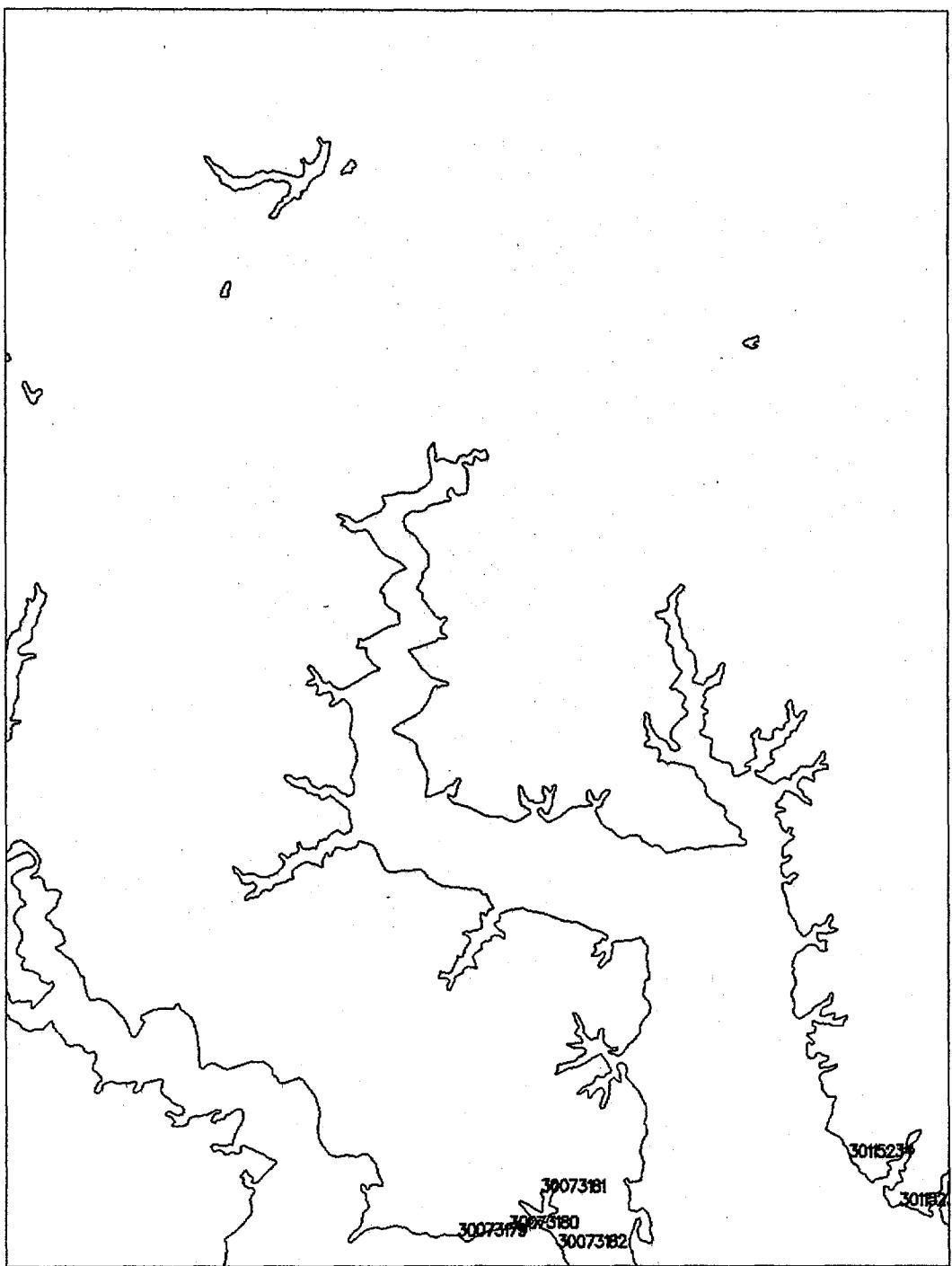
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
SURRY QUAD



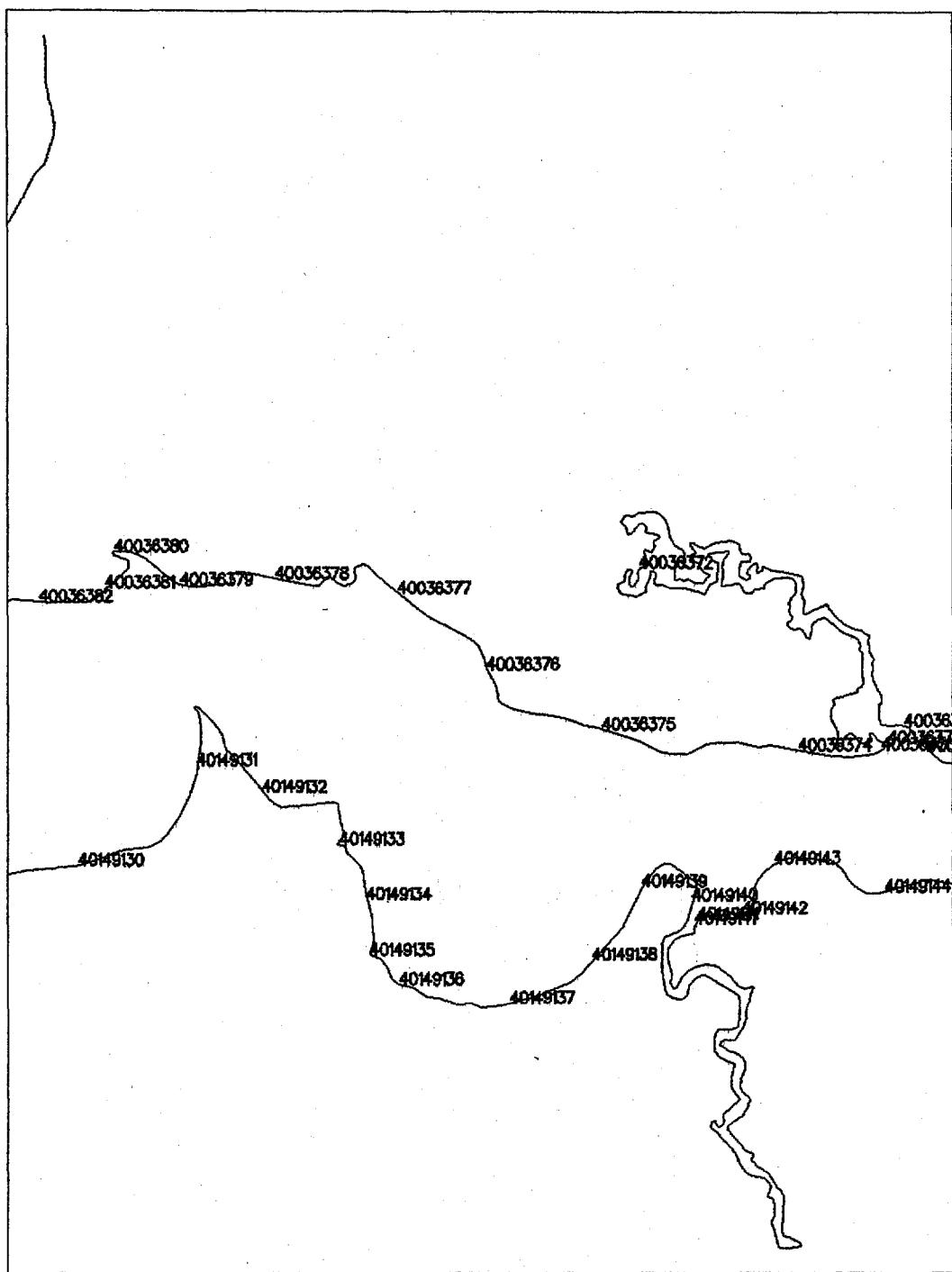
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
TOANO QUAD



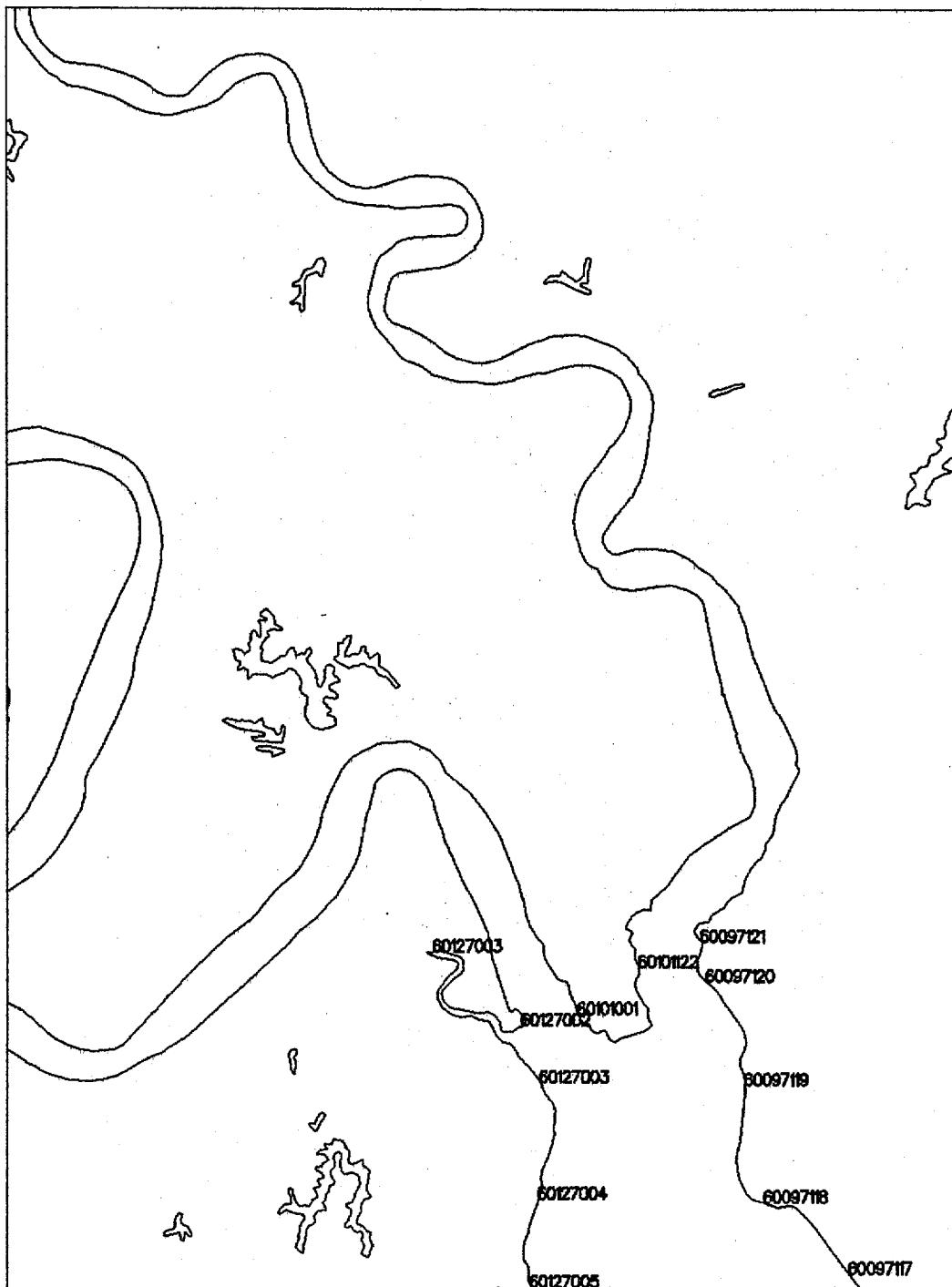
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RIVER REACH INFORMATION
REACHCODES
TOWNSEND QUAD



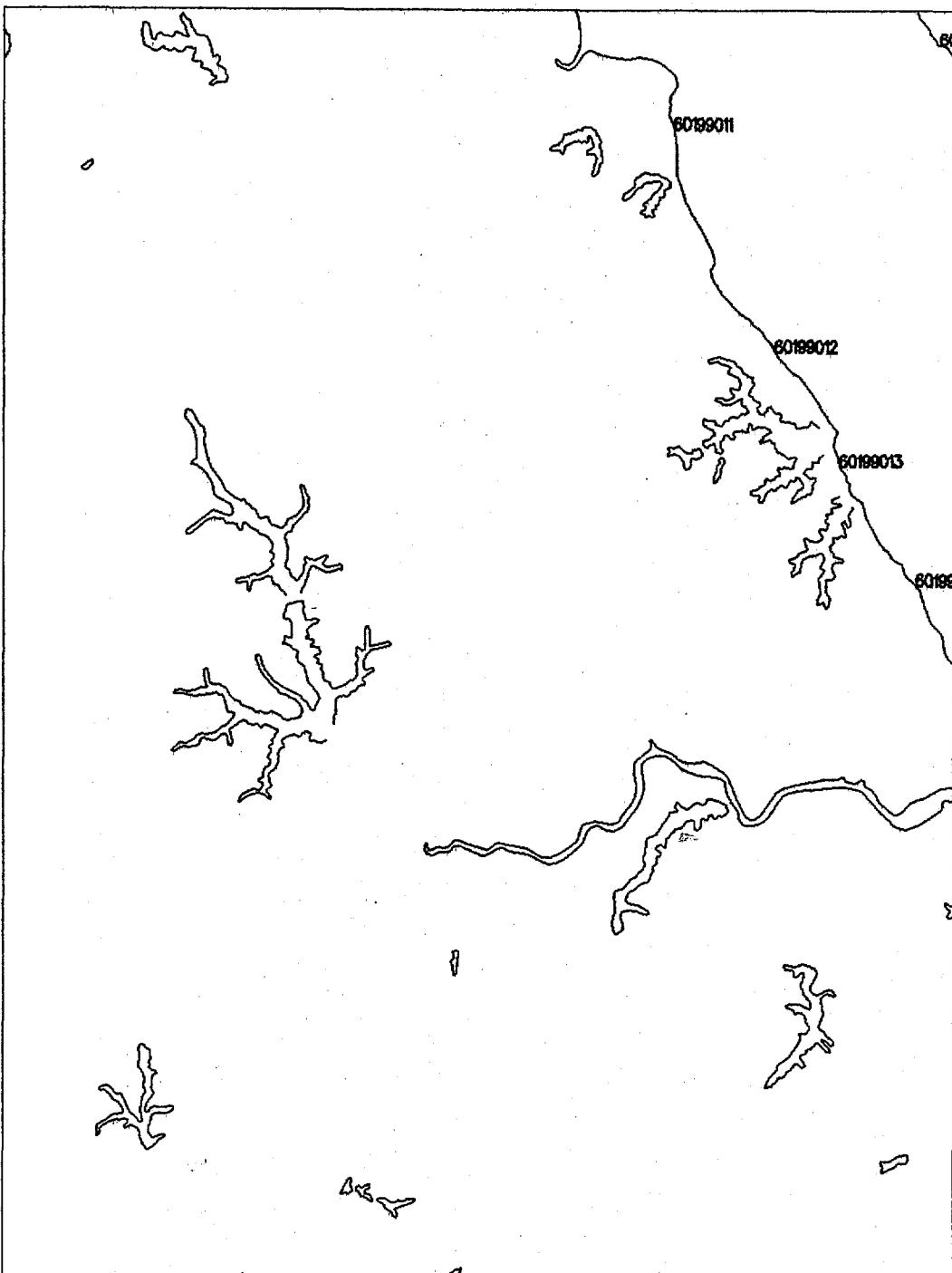
VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
WARE NECK QUAD



VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
WESTOVER QUAD



VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
WEST POINT QUAD



VIMS COASTAL INVENTORIES
RIVER REACH INFORMATION
REACHCODES
WILLIAMSBURG QUAD

**CHAPTER XIV. PROCEDURE FOR ANALYZING HISTORICAL
CHANGE IN SHORELINE POSITION**

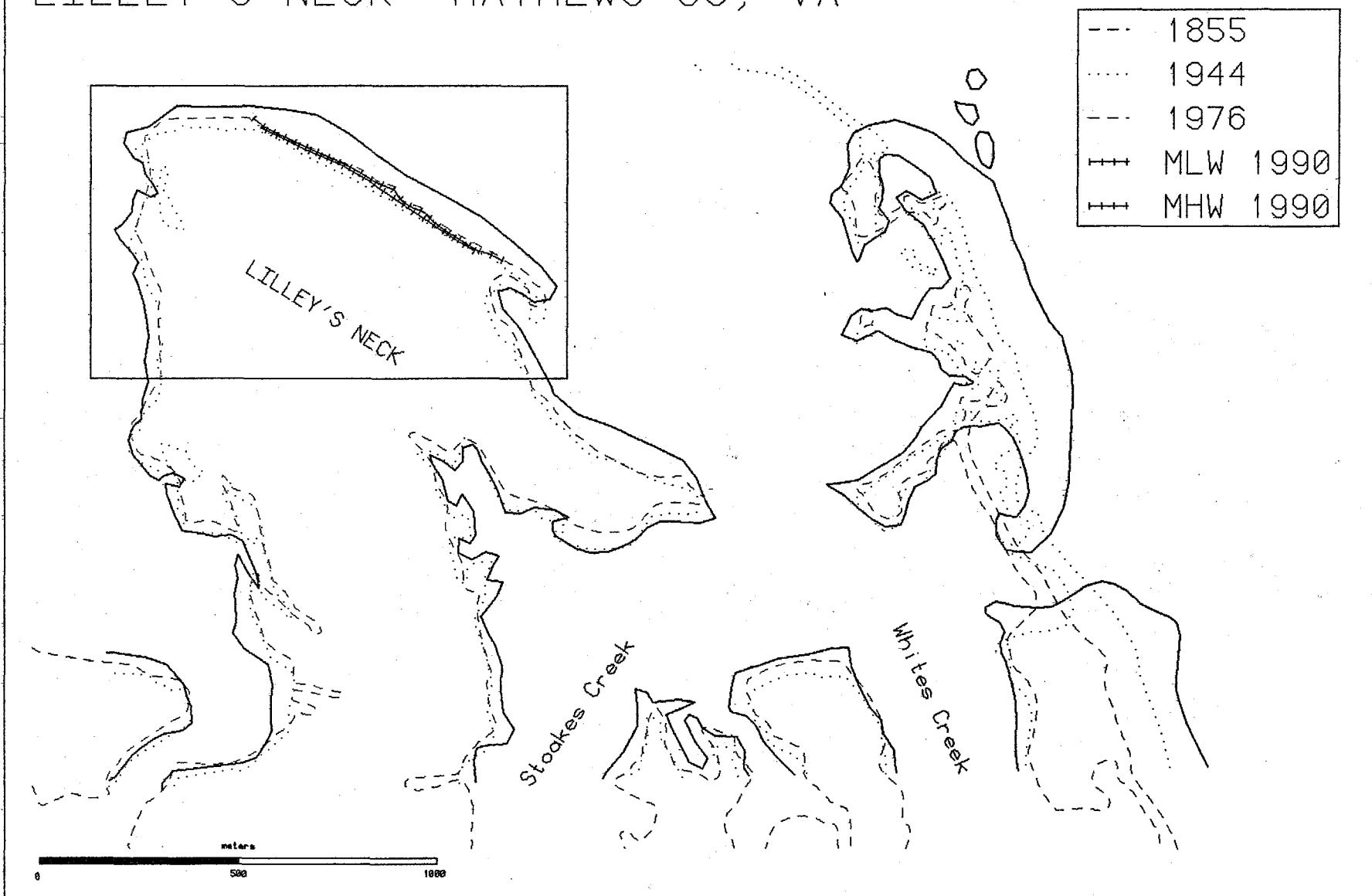
XIV. PROCEDURE FOR ANALYZING THE HISTORICAL CHANGE IN SHORELINE POSITIONS

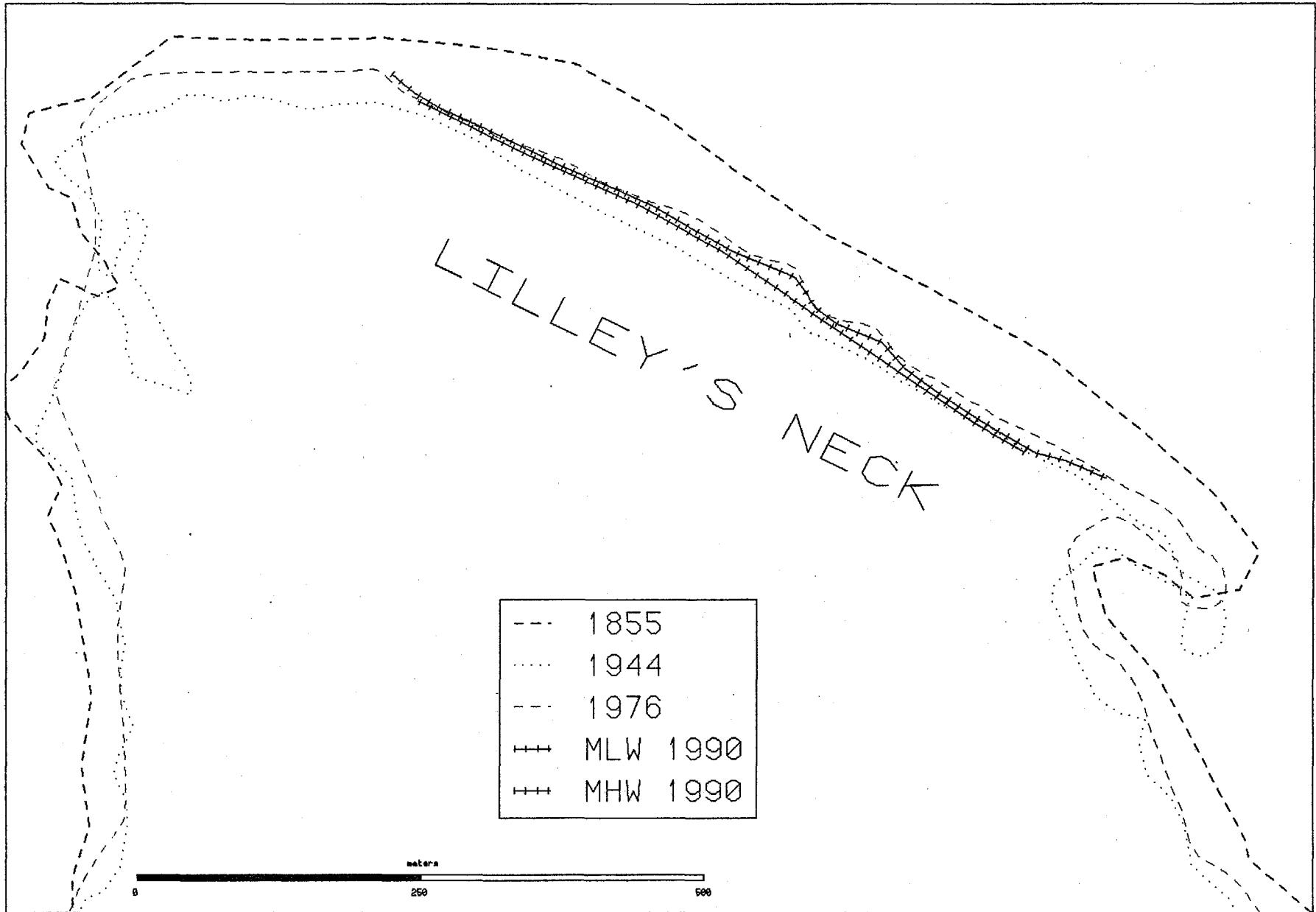
A procedure has been developed within the GIS framework to analyze and compare historic rates of shoreline change with present-day shoreline conditions. Lilleys Neck, situated northwest of Rigby Island in Mathews County, was used as a study site. Lilleys Neck, currently a refuge, is being considered for rezoning which will potentially allow for future development.

Local governments as well as state advisory agencies are interested in assessing the historic patterns in shoreline change for this reach. The 1981 VIMS Shoreline Inventory database, now an integral component of the GIS system, reports an erosion rate of 3.1 feet per year. This estimate is based on 89 years of change from 1855 to 1944.

To accurately measure the erosion rate for this time period, the 1855 shoreline, published by the U.S. Coast and Geodetic Survey (now the National Ocean Service), was digitized at a scale of 1:20,000 and entered into the GIS database. Similarly, the 1944 U.S. Geological Survey topographic map of the region was digitized at a scale of 1:24,000. When these two coverages were superimposed an approximate erosion rate for this 89-year period was computed to be 2.9 feet per year. Within the accuracy limits of the map medium, this rate is in agreement with the rate reported in the 1981 Shoreline Inventory database. A 1976 shoreline record was also digitized from the Virginia Marine Resource Commission shoreline map series which are surveyed at a scale of 1:5000. Initial interpretation of this coverage, when compared with the historic shoreline records, suggest that the position of the shoreline has accreted substantially from its position in 1944. Analysis of 1990 vertical photographs and a ground survey of Lilleys Neck, using a Topcon GTS-3B infrared digital survey instrument, indicates that the position of the current shoreline is slightly landward of the 1976 shoreline position. This suggests that presently the shoreline is undergoing recession and the shore is in a state of erosion. Observations in the field also suggest the shore to be unstable and erosion taking place.

LILLEY'S NECK MATHEWS CO., VA





**CHAPTER XV. PROCEDURE FOR ANALYZING THE EFFECTS OF
LAND USE ON VEGETATED WETLANDS**

XV. PROCEDURE FOR ANALYZING THE EFFECTS OF LAND USE ON VEGETATED WETLANDS

A procedure for analyzing the effects in upland land use on tidal wetlands has been developed to delineate vegetated habitats alongshore and spatially relate these environments to the adjacent upland land use patterns. It is accepted that man-induced influences along the shore contribute to the degradation of wetland habitats. Shore stabilization structures inhibit inland migration of tidal wetlands by blocking the natural intrusion of salt water from tidal fluctuations and rising sea level. Development has been responsible for filling existing wetlands as well as decreasing upland acreage potentially available for vegetation with sea level rise.

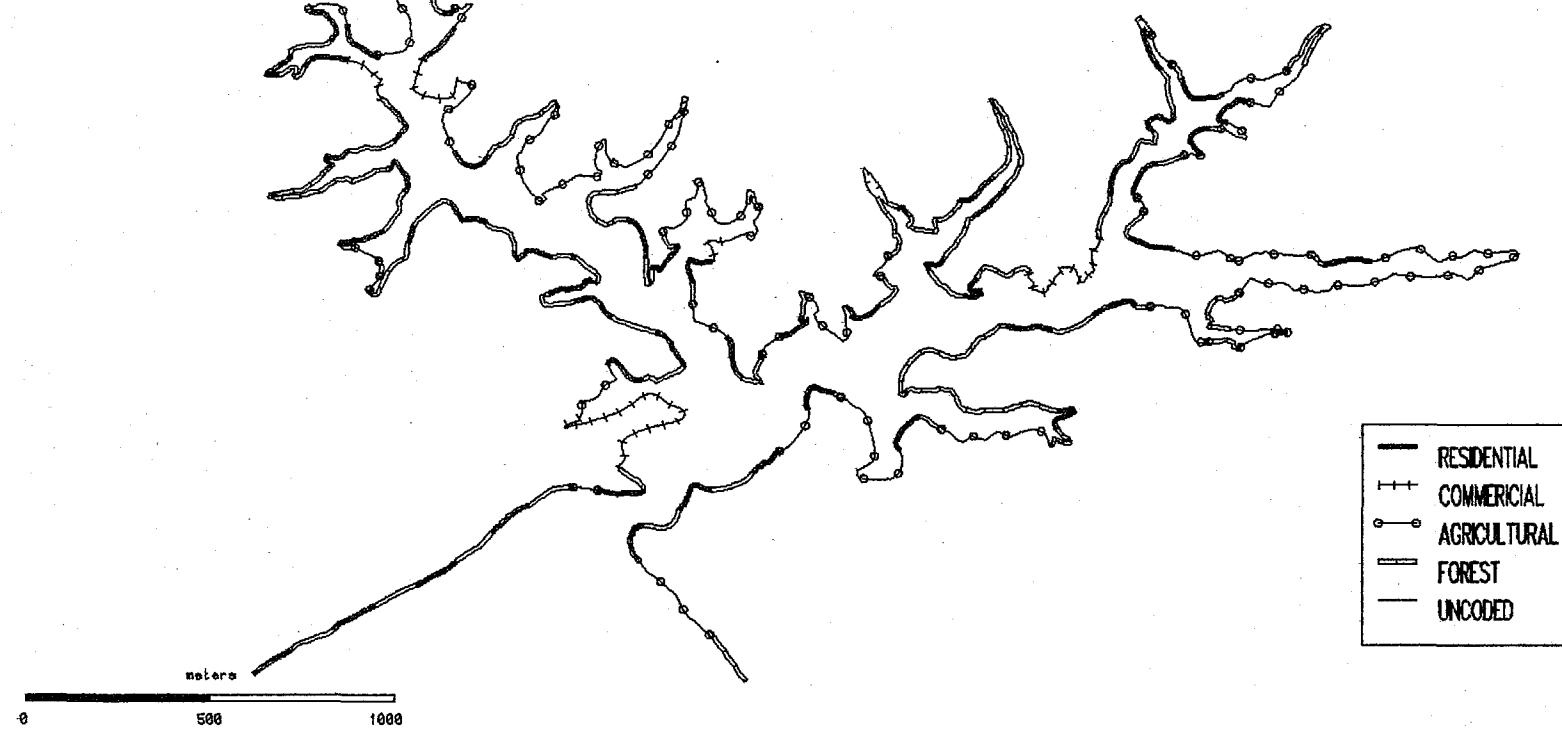
These factors and others have initiated the need for improved resource management techniques. A balance between the desire to develop within the coastal plain and the responsibilities vested in governments to protect natural resources must be established. It is suggested that the functional value of existing wetlands can be determined by examining the adjacent upland land use on a reach by reach basis. Generally, the value of an existing wetland as the potential for continued growth is inhibited by development.

Tidal waters of Sarah's Creek and Urbanna Creek were delineated using historic and present-day vertical photographs. Upland reaches were delineated by the following land use patterns: agricultural, residential, commercial and forested. Shoreline type for historic photographs were delineated on the basis of vegetated or nonvegetated shore. Analysis of recent photographs analysed was expanded to include riprap and bulkhead structures. The tidal watershed of these creeks were ground-truthed between August and September of 1990 for accuracy in photo interpretation.

Delineations were plotted on existing 1:24,000 shoreline records in the VIMS GIS. Data was stored as two separate coverages: land use and shore condition. Nodes were entered directly to form the longshore borders of each attribute identified. Arcs were created by connecting nodes and then coded according to shore type or land usage. The length of each arc is calculated and can be totaled, if desired, for an individual attribute (e.g. total vegetated shore, forested upland, etc.). Shore condition can then be assessed and directly compared with land use patterns when the two coverages are superimposed. Historical overlays can be produced to assess changes in shoreline conditions as a function of changes in land use patterns. A decrease in vegetated shore coverage resulting from increased development could be detected. Results of historical comparisons can be used as a tool to predict the functional value of existing wetlands in lieu of present-day land uses.

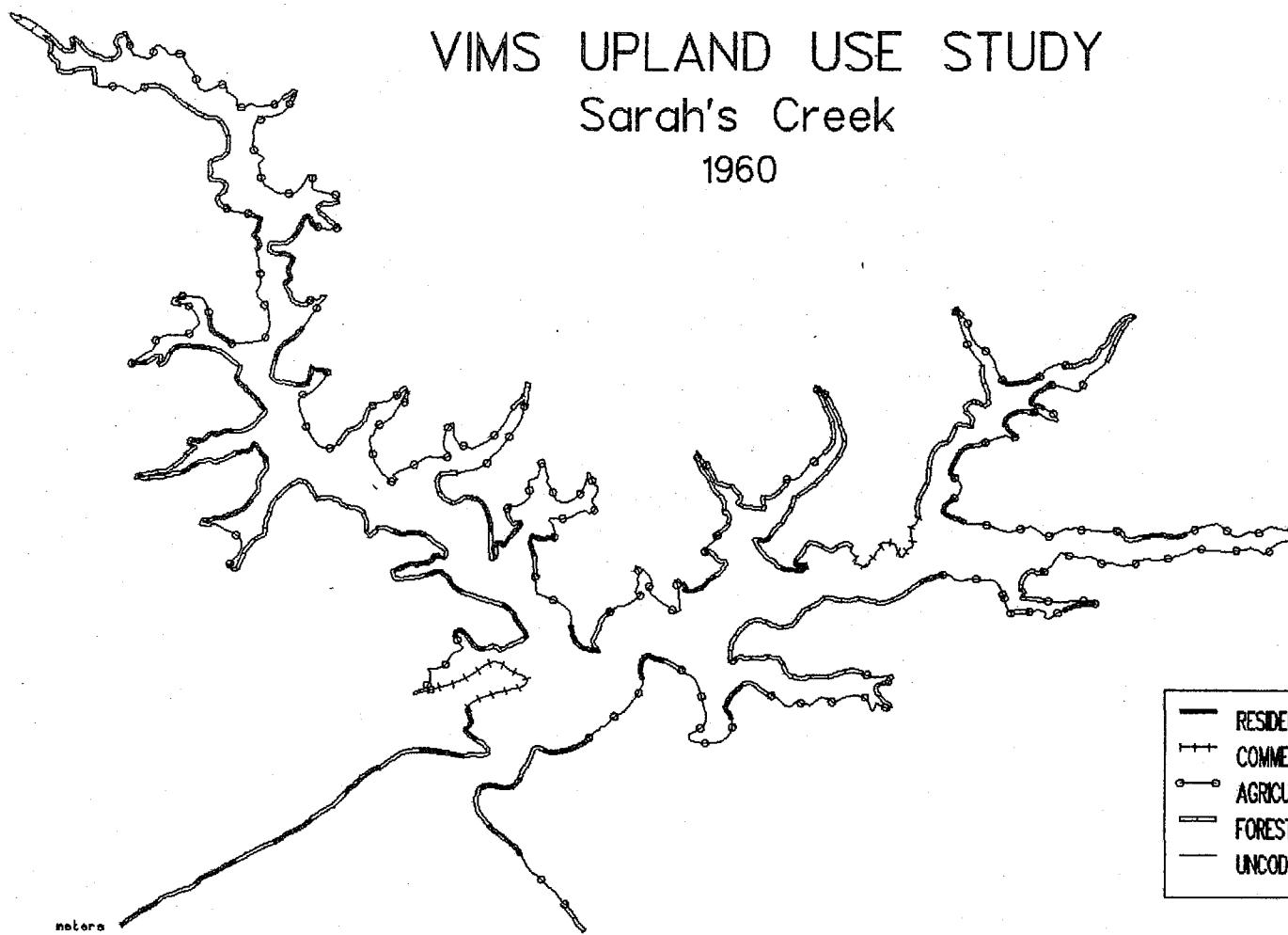
VIMS UPLAND USE STUDY
Sarah's Creek
1953

147

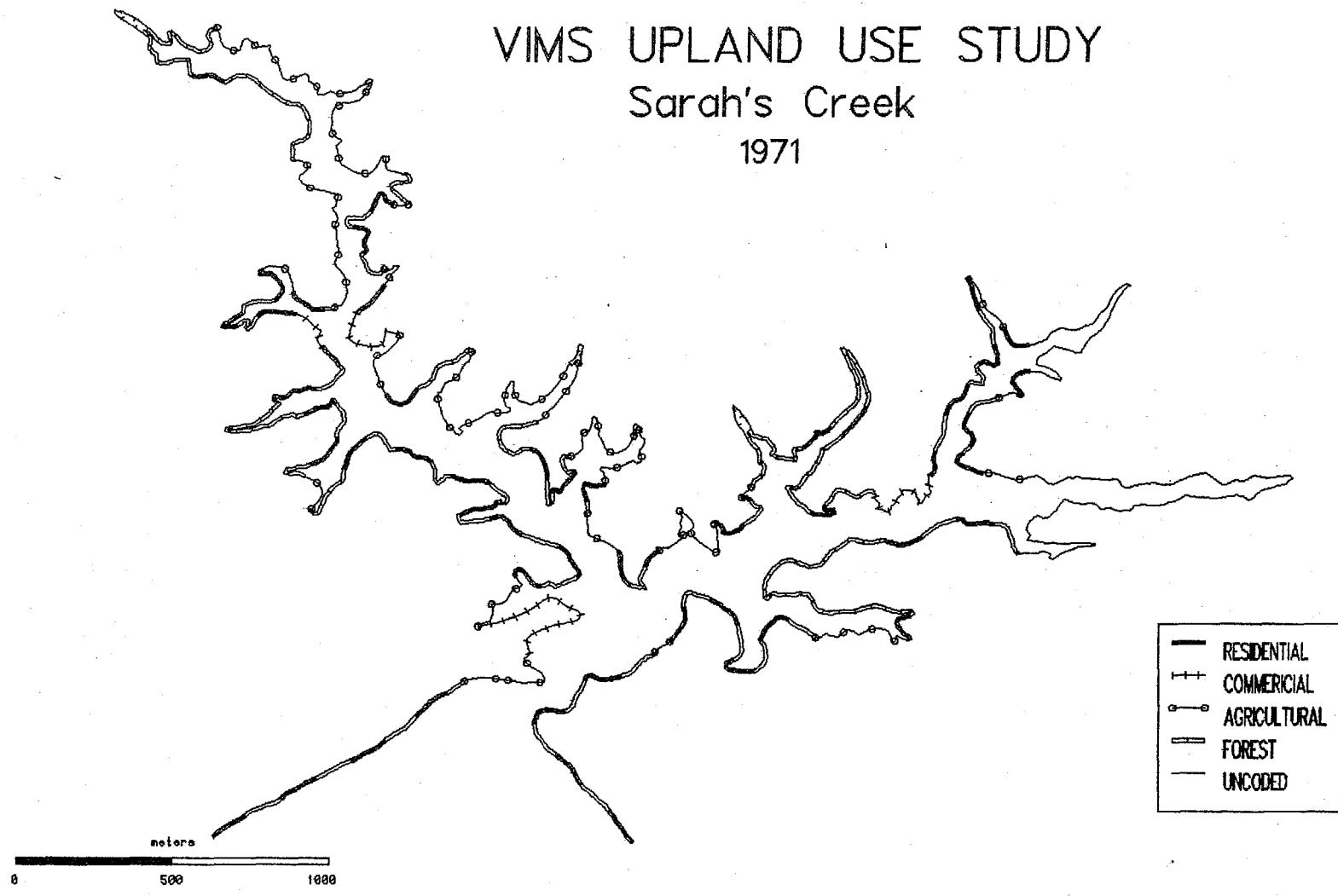


VIMS UPLAND USE STUDY
Sarah's Creek
1960

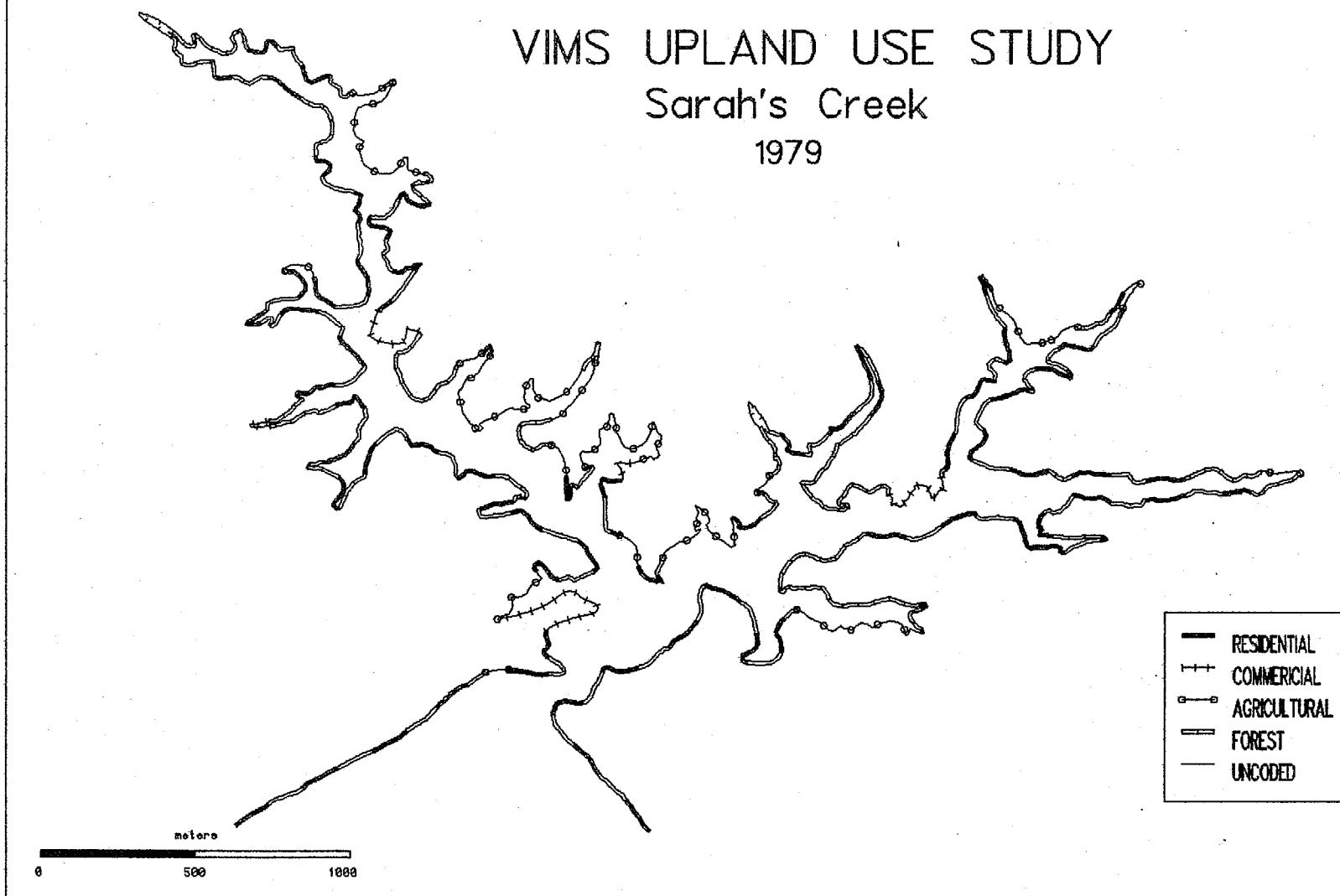
148



VIMS UPLAND USE STUDY
Sarah's Creek
1971

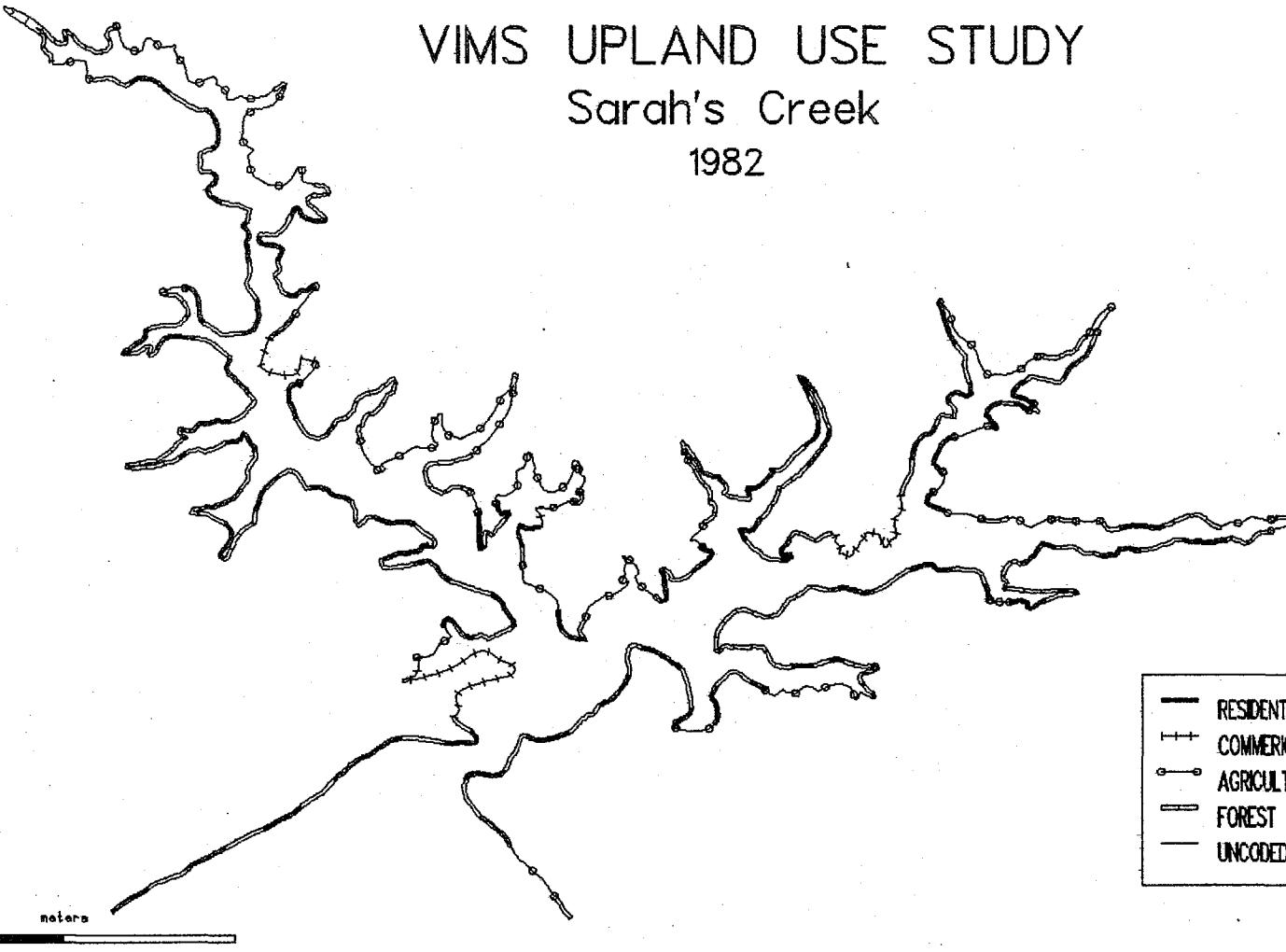


VIMS UPLAND USE STUDY
Sarah's Creek
1979

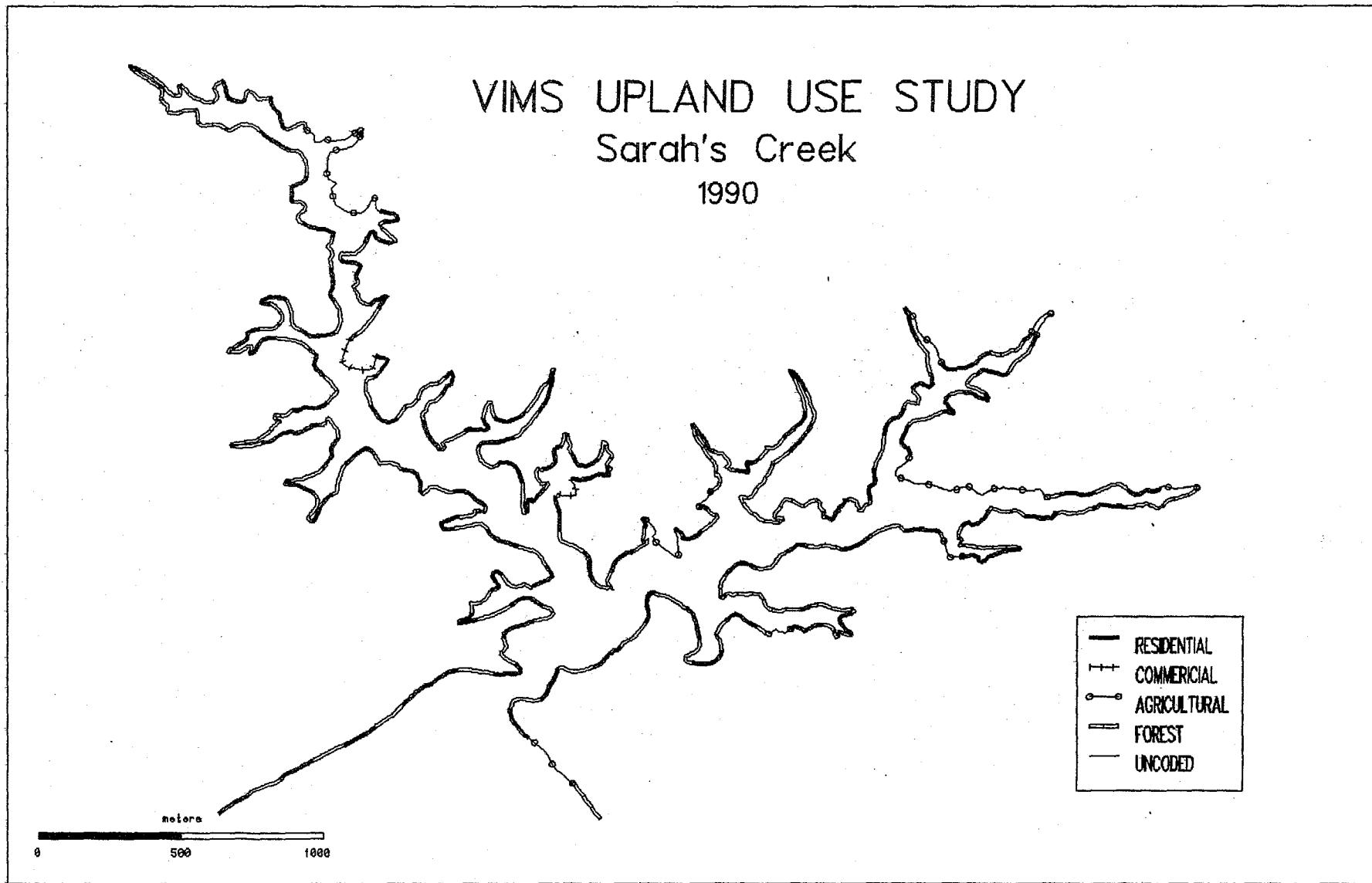


VIMS UPLAND USE STUDY
Sarah's Creek
1982

151

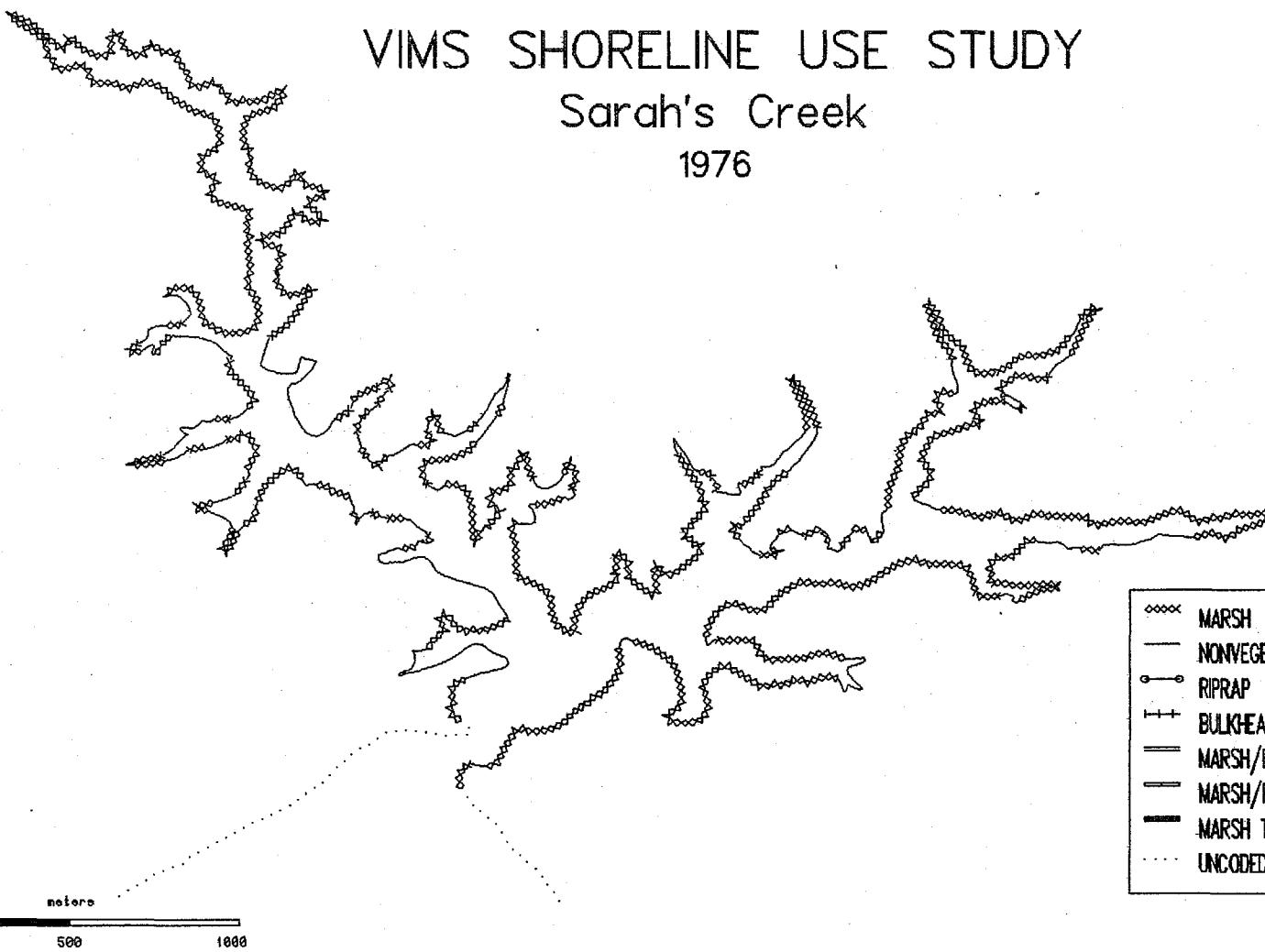


VIMS UPLAND USE STUDY
Sarah's Creek
1990



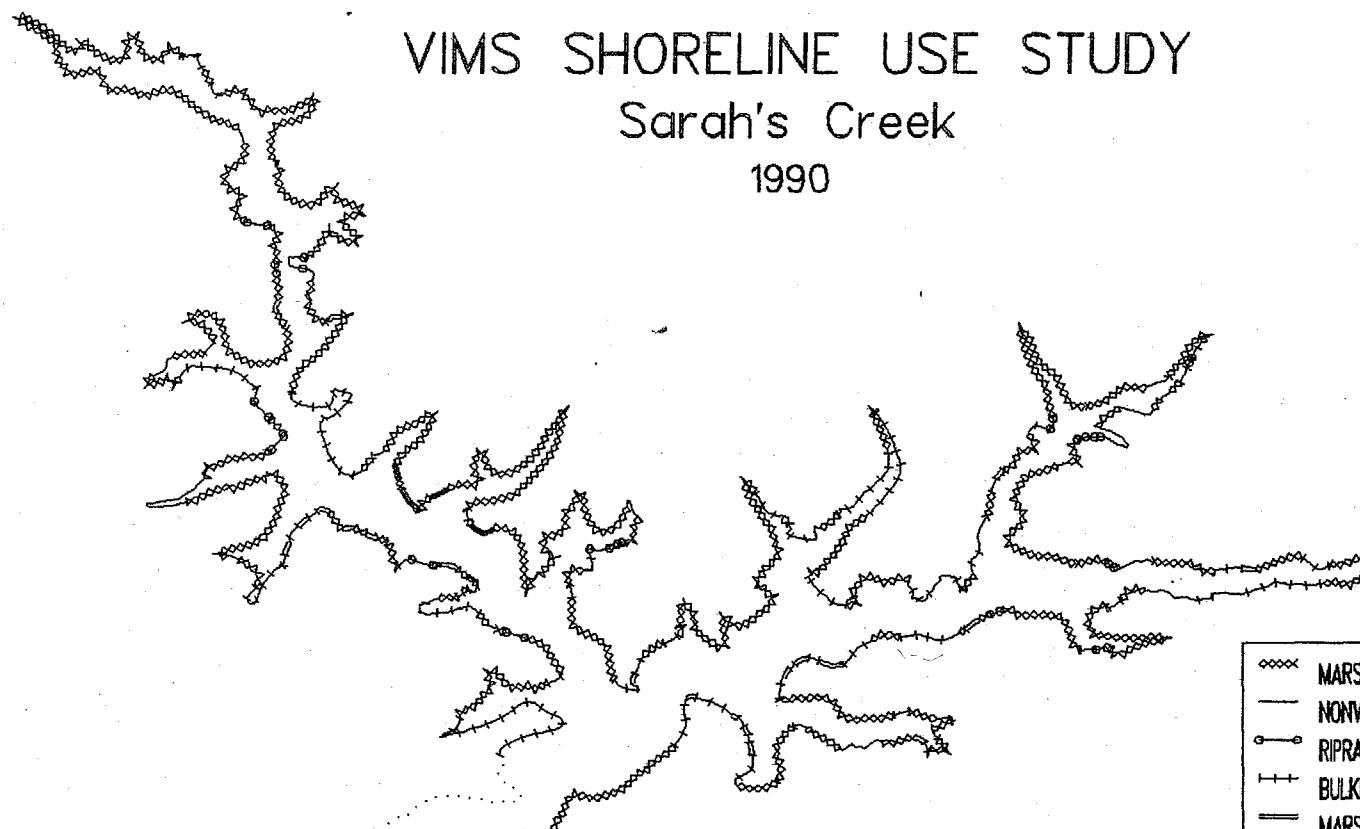
VIMS SHORELINE USE STUDY
Sarah's Creek
1976

153



VIMS SHORELINE USE STUDY
Sarah's Creek
1990

154

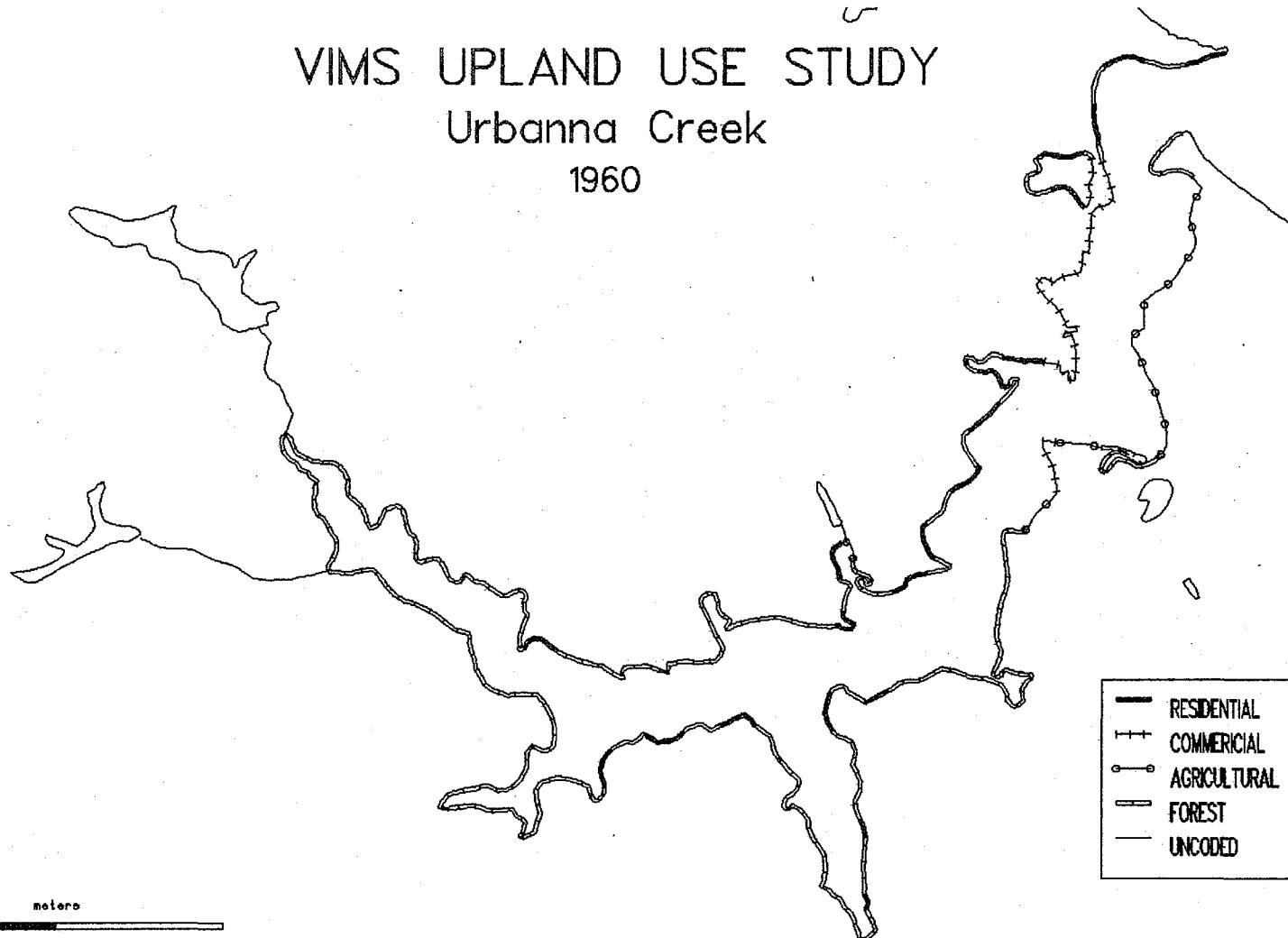


- xxxxx MARSH
- NONVEGETATED
- RIPRAP
- ++ BULKHEAD
- MARSH/BULKHEAD
- MARSH/RIPRAP
- MARSH TOE
- ... UNCODED SHORELINE

meters
0 500 1000

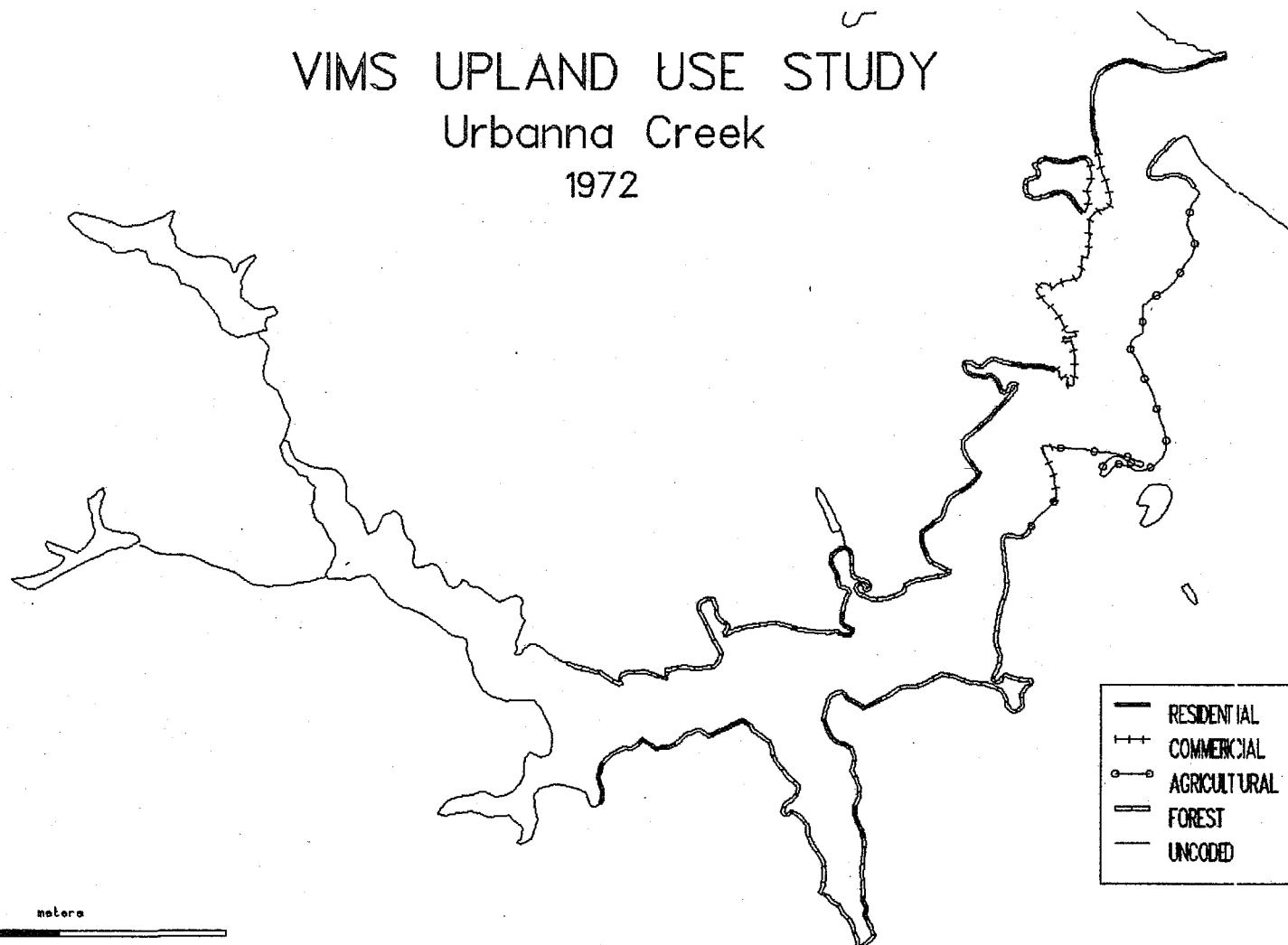
VIMS UPLAND USE STUDY
Urbanna Creek
1960

155



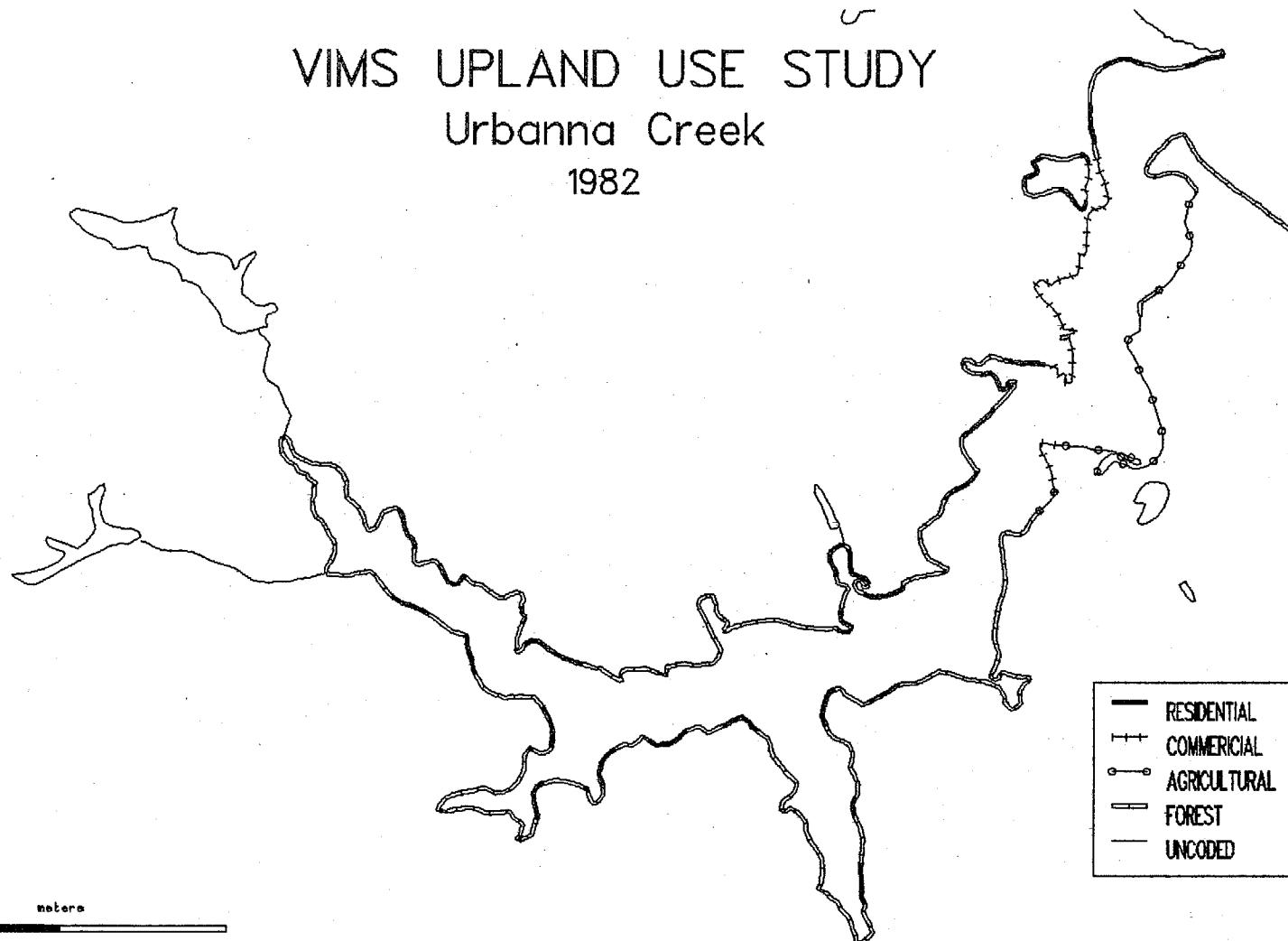
VIMS UPLAND USE STUDY
Urbanna Creek
1972

- RESIDENTIAL
- ++ COMMERCIAL
- AGRICULTURAL
- FOREST
- UNCODED

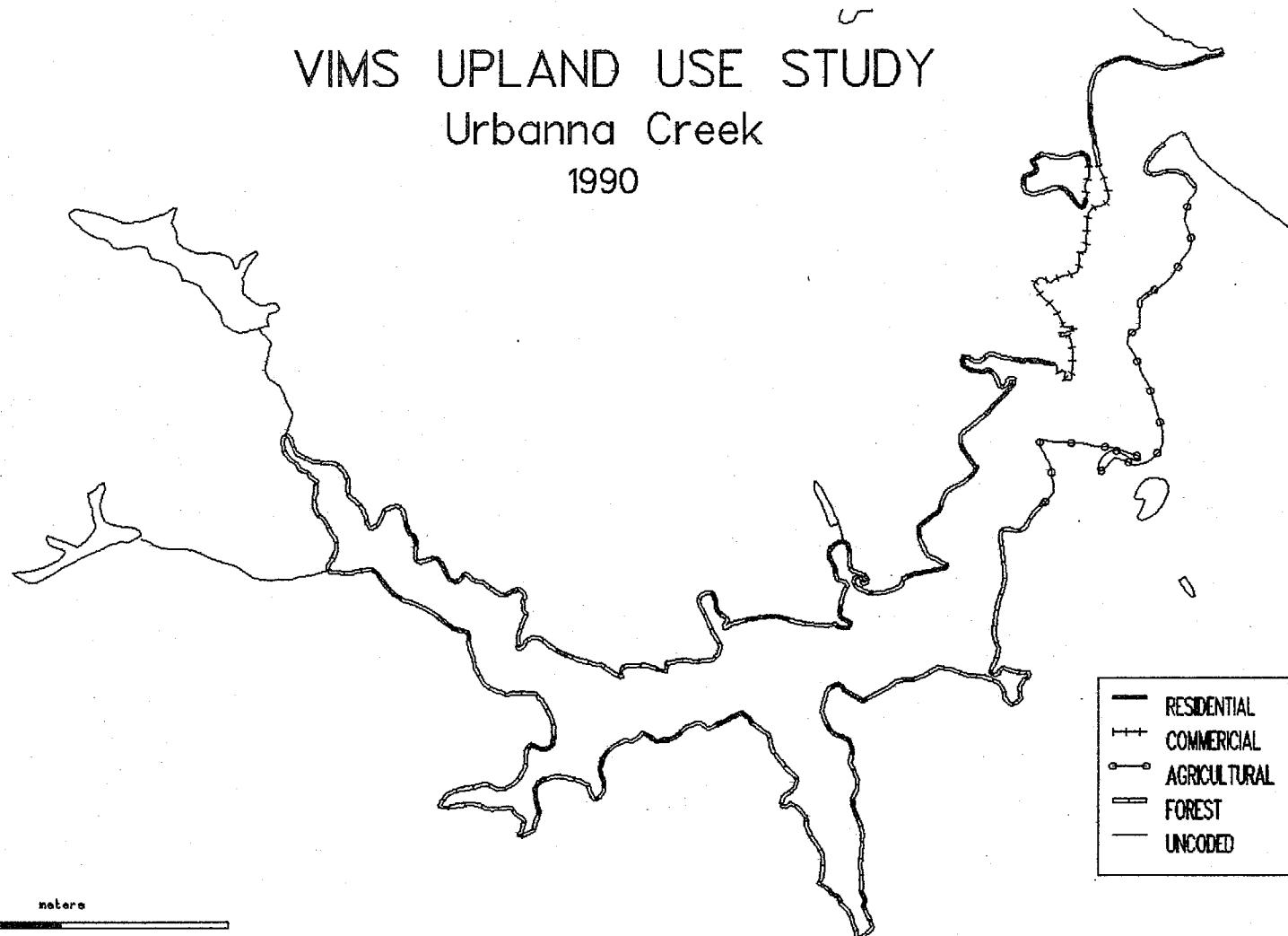


VIMS UPLAND USE STUDY
Urbanna Creek
1982

157

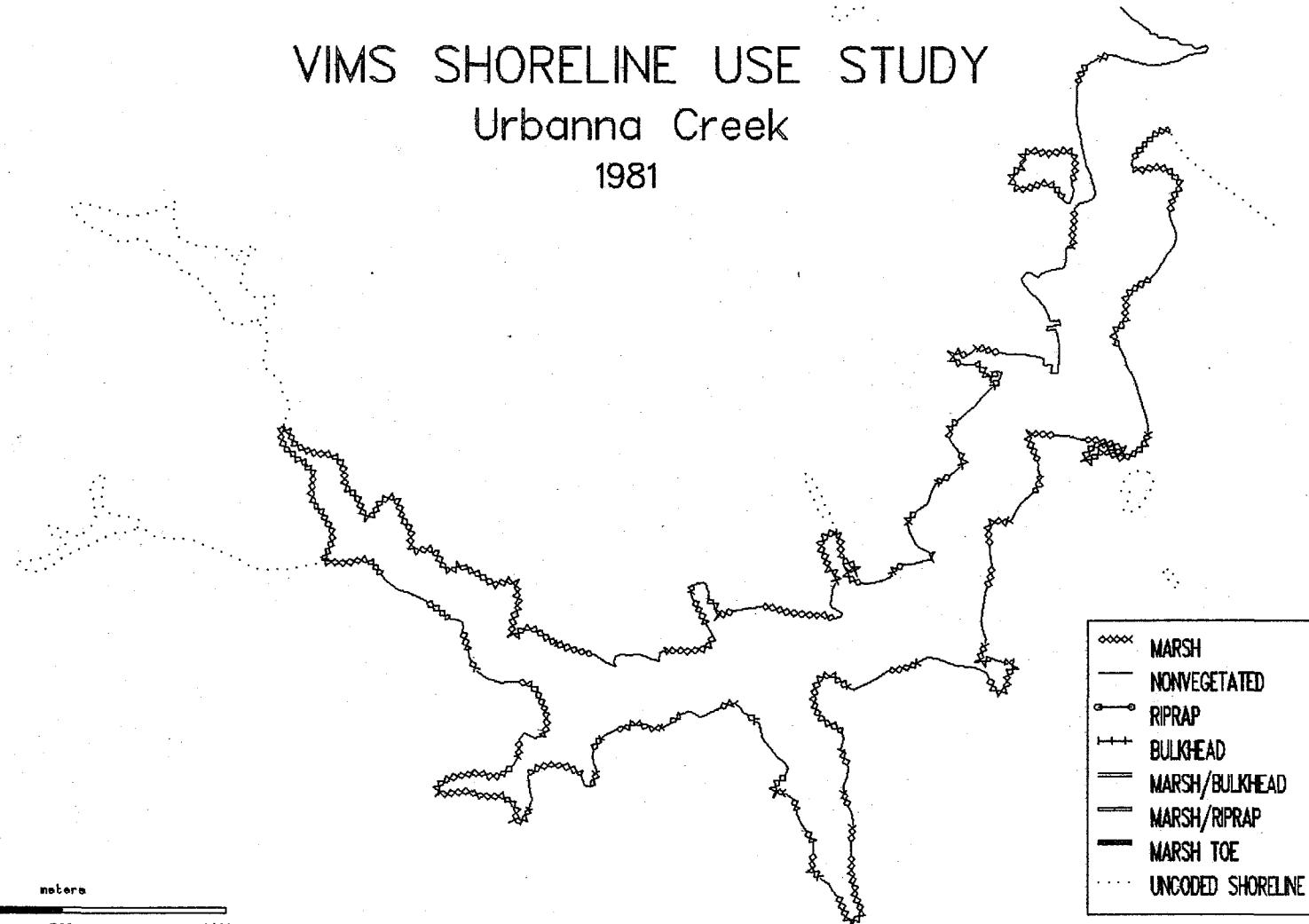


VIMS UPLAND USE STUDY
Urbanna Creek
1990

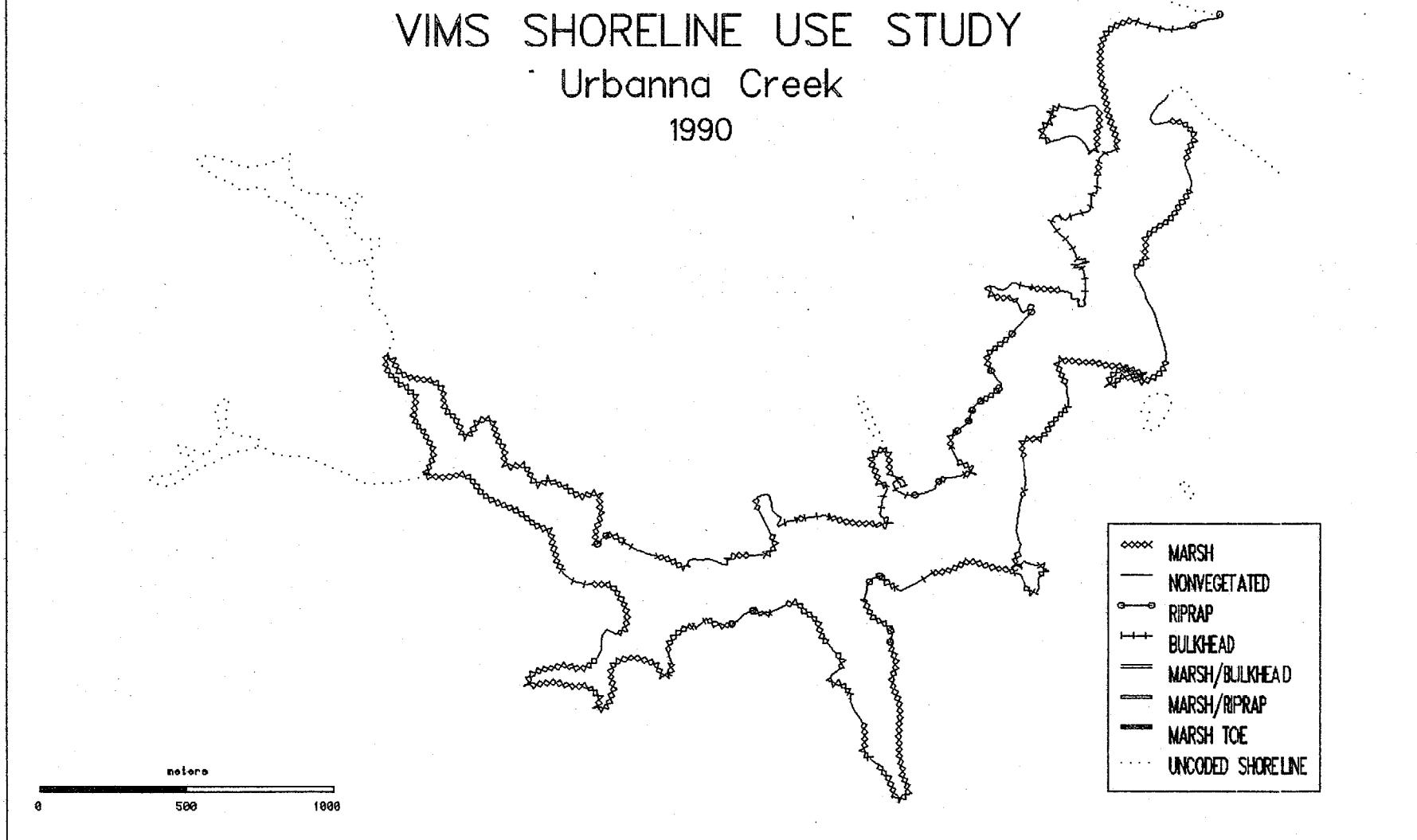


VIMS SHORELINE USE STUDY
Urbanna Creek
1981

159



VIMS SHORELINE USE STUDY
Urbanna Creek
1990



**CHAPTER XVI. PROCEDURE FOR ANALYZING SPATIAL AND
TEMPORAL CHANGES IN WETLAND SPECIES**

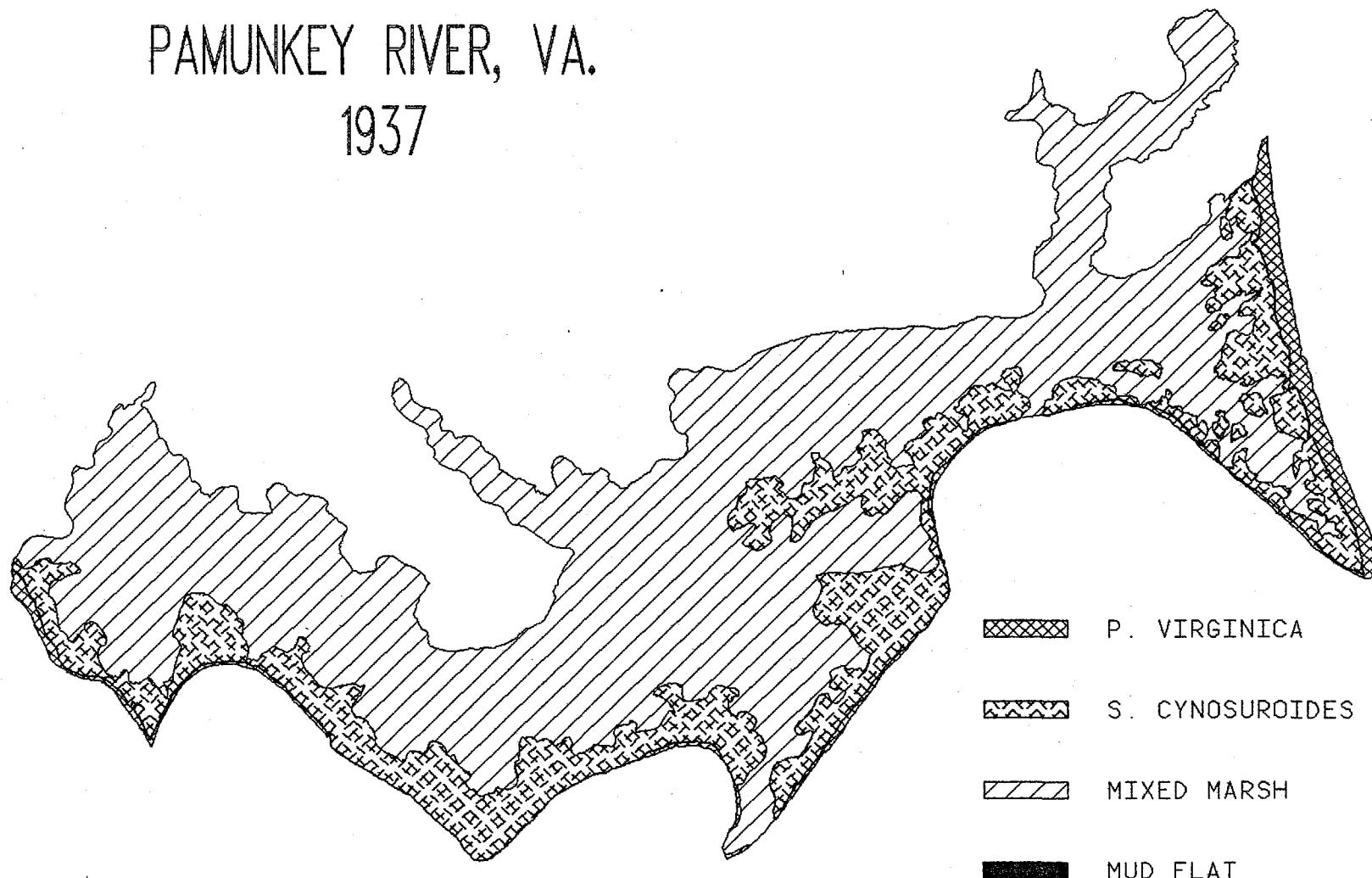
XVI. PROCEDURE FOR ANALYZING THE SPATIAL AND TEMPORAL CHANGES IN WETLAND SPECIES

A procedure to quantify the spatial and temporal change in wetland species and habitats has been developed by the Coastal Inventory in cooperation with staff of the Wetlands Research Program. A sixty (60) hectare section of Sweethall Marsh in King William County was delineated from six (6) sets of vertical imagery photographed between 1938 and 1976. Arrow Arum (*Peltandra virginica*), Big Cordgrass (*Spartina cynosuroides*), a mixed marsh assemblage, and a tidal mudflat was hand-traced directly from the photographs for each year. Each delineation was then digitized and coded by species and entered into the GIS database. Since the delineations formed polygons, the acreage for any one species could be calculated for a given year.

As expected, the results of the study indicated that species sensitive to high salinity environments (e.g., mixed marsh assemblage) spatially decreased over time and were eventually eradicated from the population. Species like Big Cordgrass, which are salt tolerant, increased spatially over time. Those species thriving in the tidal mudflat which could not tolerate high salinity environments were eventually replaced with species like Big Cordgrass which could. The temporal changes are likely due to an increase in salinity from external environmental pressures, and an increase in salt water inundation as a result of sea level rise.

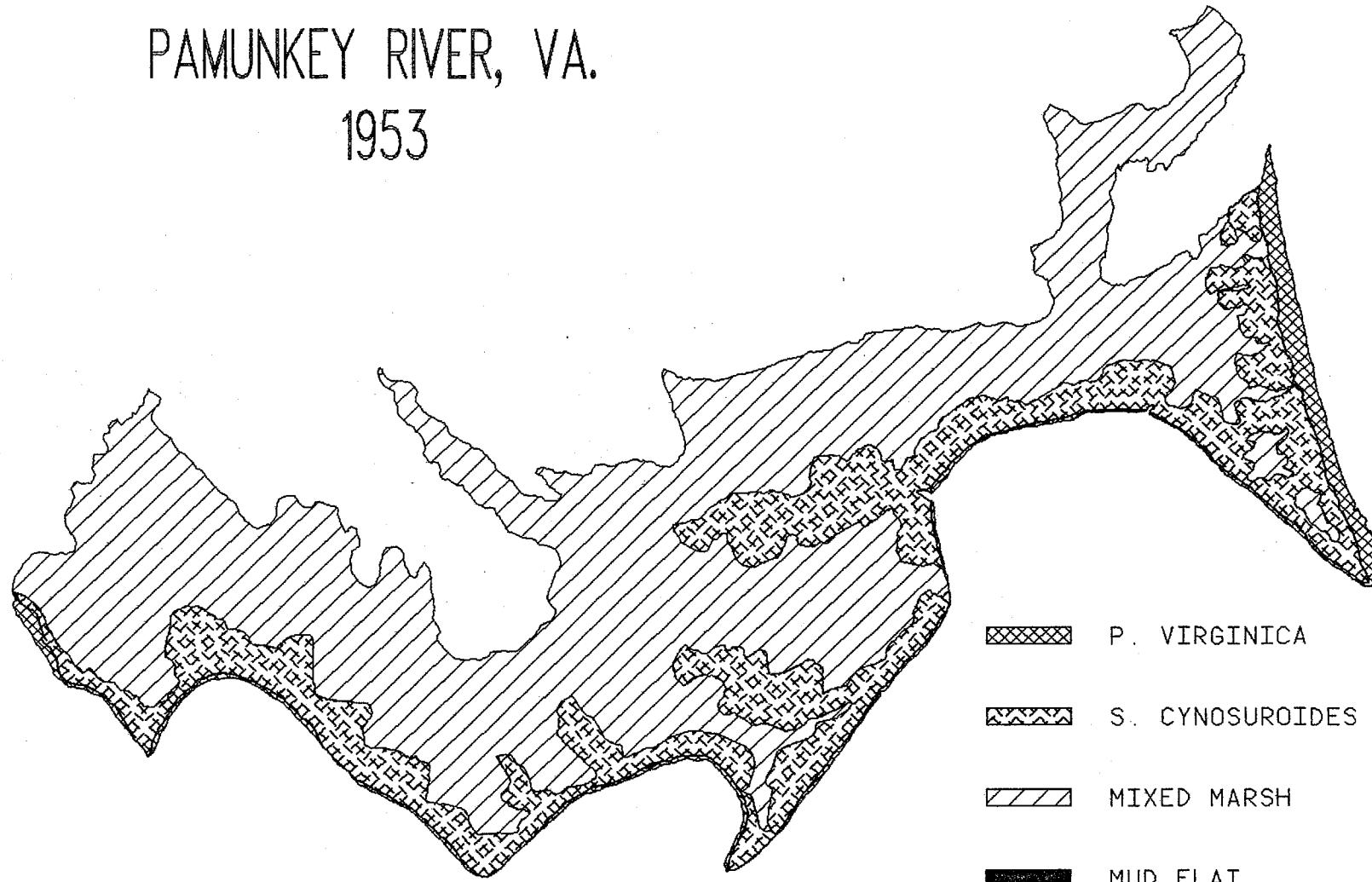
UPPER LIMITS SWEET HALL MARSH
PAMUNKEY RIVER, VA.

1937



UPPER LIMITS SWEET HALL MARSH
PAMUNKEY RIVER, VA.

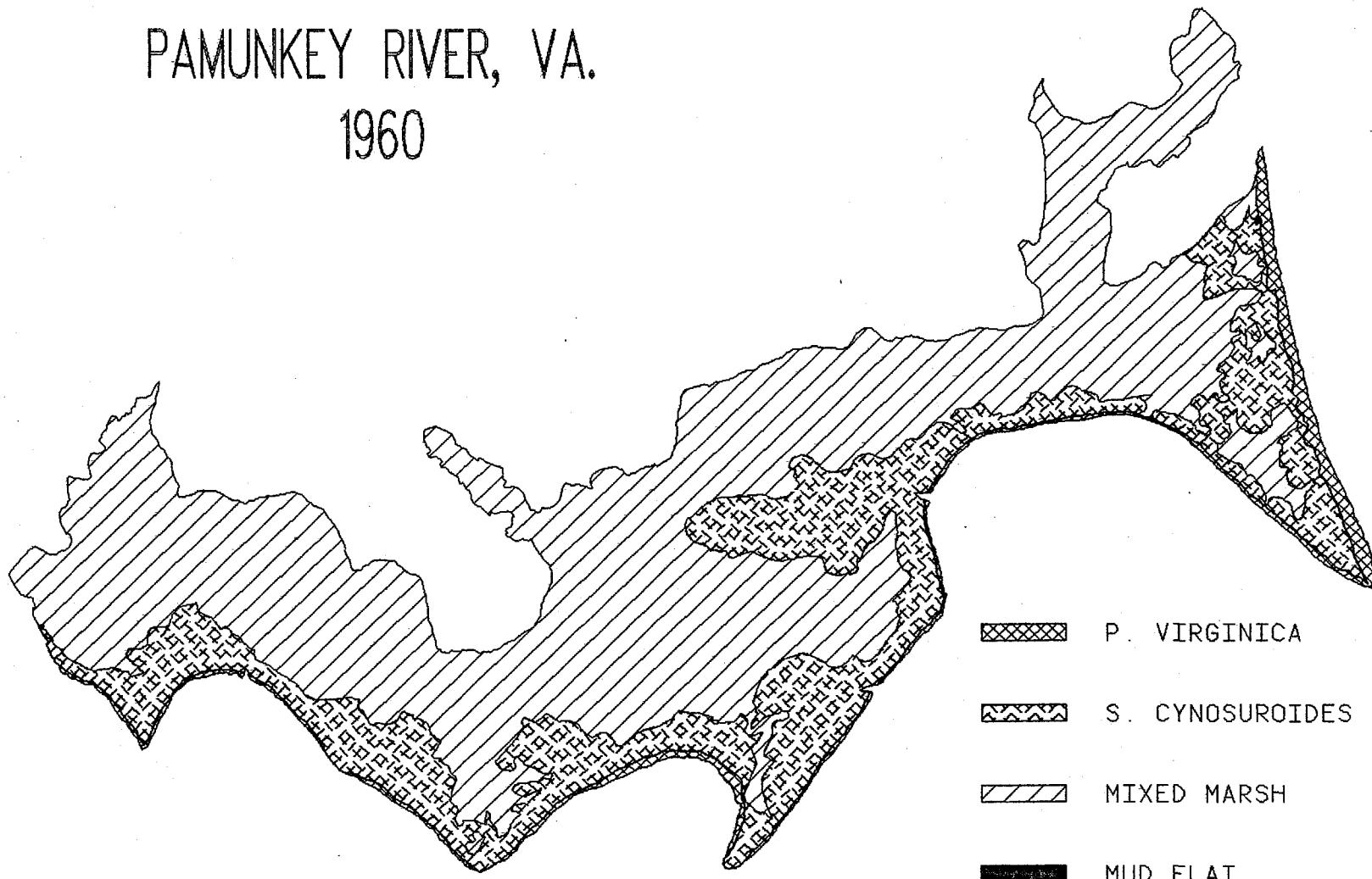
1953



UPPER LIMITS SWEET HALL MARSH
PAMUNKEY RIVER, VA.

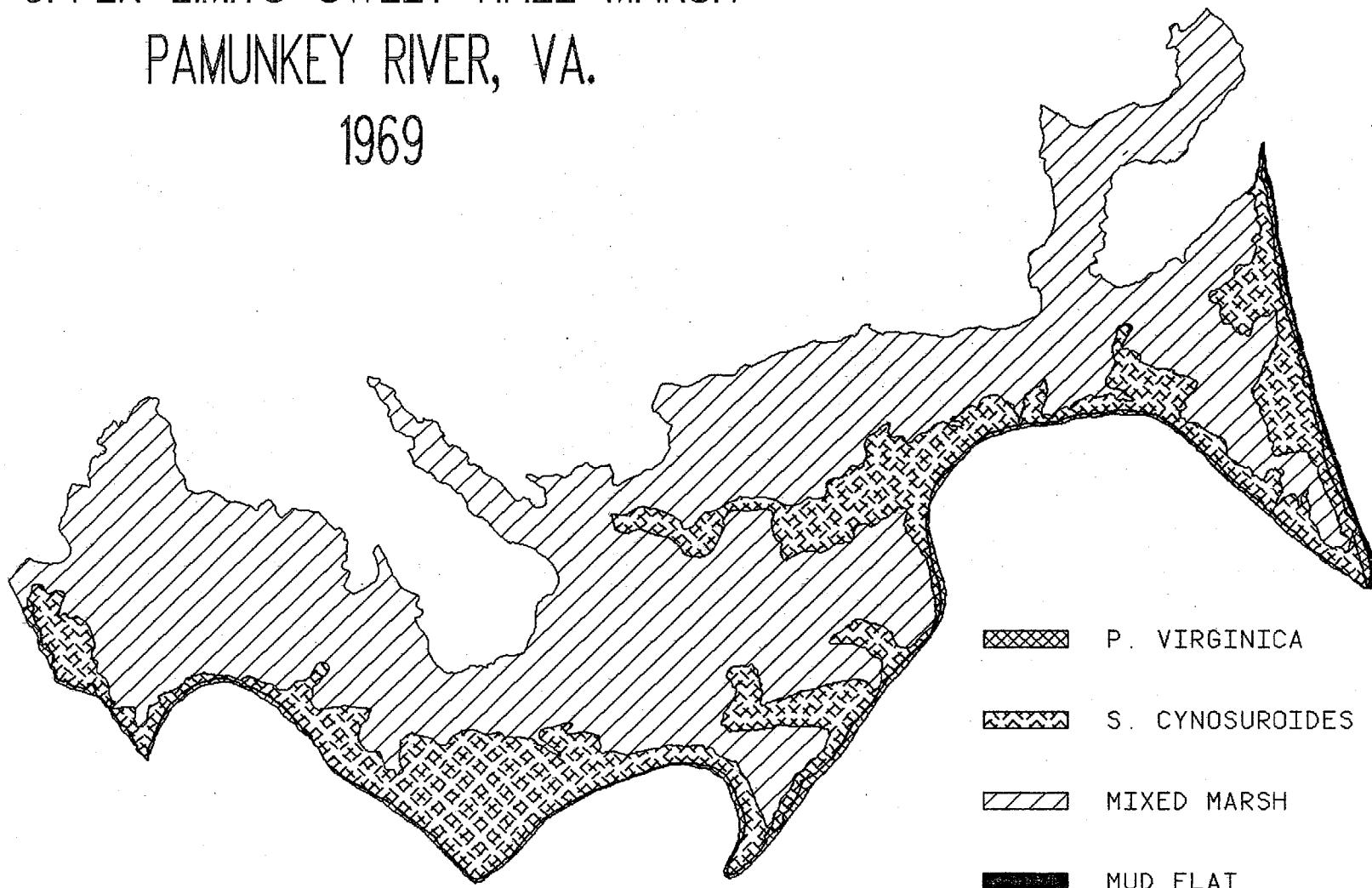
1960

164



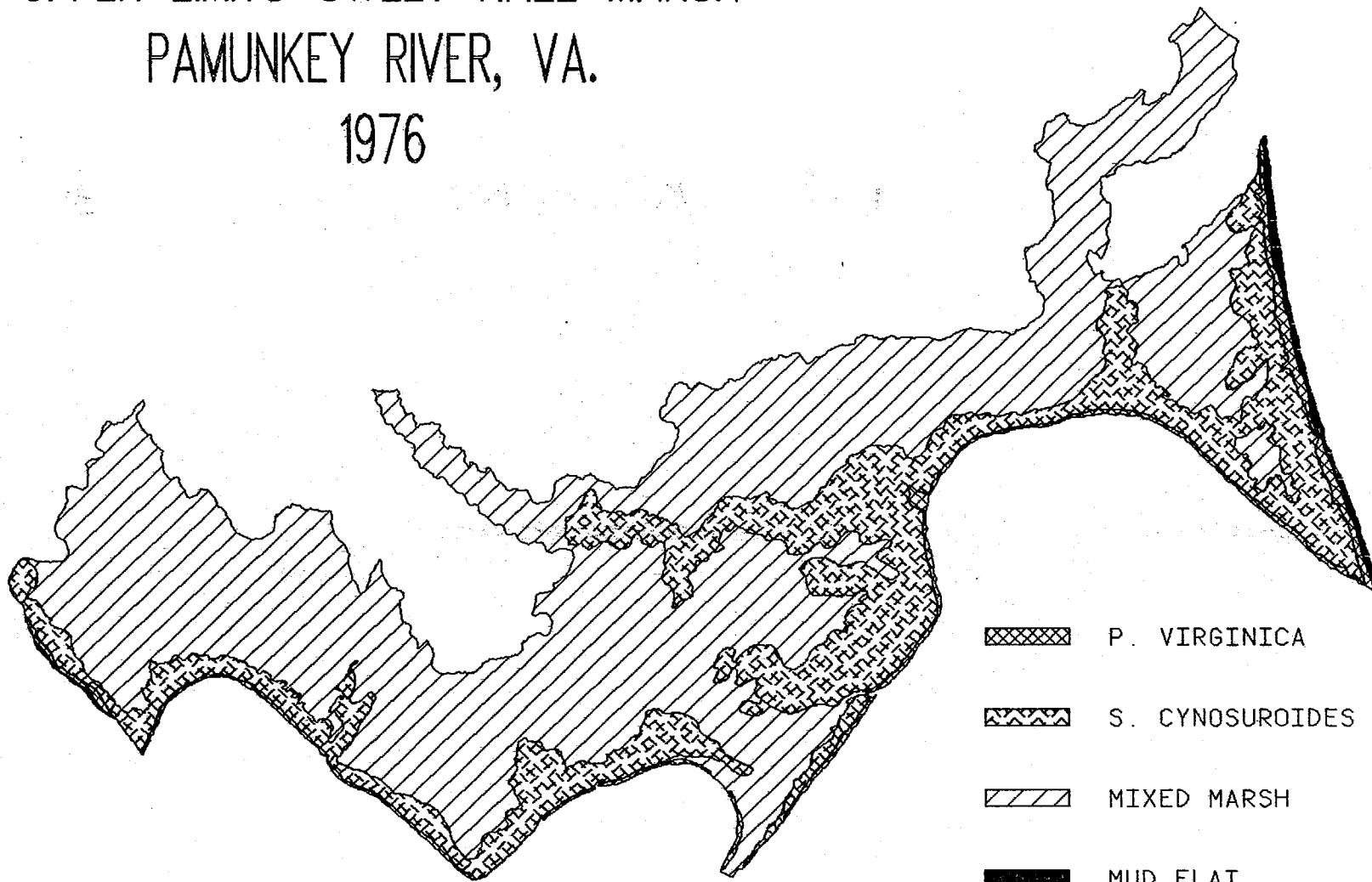
UPPER LIMITS SWEET HALL MARSH
PAMUNKEY RIVER, VA.

1969



UPPER LIMITS SWEET HALL MARSH
PAMUNKEY RIVER, VA.

1976



APPENDICES

APPENDIX I.

COMPREHENSIVE COASTAL INVENTORY

COMPLETED TOPOGRAPHIC COVERAGES

| QUAD NAME
& NUMBER | SHO | WAT | TMI | NWI | LRB | RVR | SHL | FPA | ECO | ERP | FLL |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ACHILLES
<u>5907</u> | 0 | | | X | X | 0 | | | | X | |
| BEULAHVILLE
<u>5311</u> | * | | | | | | | | | | |
| CHAMPLAIN
<u>5513</u> | 0 | X | X | X | 0 | | | | | X | |
| CLAY BANK
<u>5807</u> | 0 | | X | X | 0 | | | | X | X | |
| COLONIAL BEACH NORTH
<u>5515</u> | 0 | X | X | X | 0 | | | | | X | |
| COLONIAL BEACH SOUTH
<u>5514</u> | 0 | X | X | X | 0 | | | | | X | |
| DAHLGREN
<u>5415</u> | 0 | | | | 0 | | | | | X | |
| DELTAVILLE
<u>6009</u> | | | | X | X | 0 | | | | | |
| FLEETS BAY
<u>6010</u> | 0 | | X | X | 0 | | | | | | |
| GRESSIT
<u>5708</u> | | | | X | X | | | | X | X | |
| HANOVER
<u>5211</u> | * | | | | | | | | | | |
| HEATHSVILLE
<u>5912</u> | 0 | | X | X | 0 | | | | | | |
| IRVINGTON
<u>5910</u> | | X | | X | X | X | | | | | |
| KING & QUEEN COURTHOUSE
<u>5510</u> | * | * | * | | | | | | | | |
| KING WILLIAM
<u>5410</u> | * | * | * | X | | | | | | | |
| KINSALE
<u>5813</u> | 0 | | X | X | 0 | | | | | X | |
| LORETO
<u>5413</u> | 0 | | | | 0 | | | | | X | |
| MACHODOC
<u>5713</u> | 0 | | X | X | 0 | | | | | X | |
| MANQUIN
<u>5310</u> | * | * | * | X | | | 0 | | | | |
| MATHEWS
<u>6008</u> | | | | X | X | 0 | | | | X | |

| QUAD NAME
& NUMBER | SHO | WAT | TMI | NWI | LRB | RVR | SHL | FPA | ECO | ERP | FLL |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| MORATICO | | | | | | | | | | | |
| <u>5711</u> | | | | 0 | | X | X | 0 | | | |
| NEW KENT | | | | | | | | | | | |
| <u>5509</u> | * | * | * | * | | | | | | | |
| NEW POINT COMFORT | | | | | | | | | | | |
| <u>6007</u> | | | | 0 | | X | X | 0 | | X | X |
| PINEY POINT | | | | | | | | | | | |
| <u>5814</u> | | | | 0 | | X | X | 0 | | | X |
| POQUOSON EAST | | | | | | | | | | | |
| <u>6006</u> | | | | | | | X | X | 0 | X | X |
| POQUOSON WEST | | | | | | | X | X | | | X |
| <u>5906</u> | | | | | | | X | X | | | |
| QUINTON | | | | | | | | | | | |
| <u>5309</u> | * | | | | X | | | | | | |
| REEDSVILLE | | | | | | | | | | | |
| <u>6011</u> | | | | 0 | | X | X | 0 | | | |
| ROLLINS FORK | | | | | | | | | | | |
| <u>5414</u> | | | | 0 | | | | 0 | | | X |
| ST. CLEMENTS ISLAND | | | | | | | | | | | |
| <u>5714</u> | X | | | X | X | X | X | X | X | | X |
| ST. GEORGE ISLAND | | | | | | | | | | | |
| <u>5913</u> | | | | 0 | | X | | 0 | | | |
| SEVEN PINES | | | | | | | | | | | |
| <u>5209</u> | | * | | | | | | | | | |
| STRATFORD HALL | | | | | | | | | | | |
| <u>5614</u> | | | | X | X | X | X | X | | | X |
| STUDLEY | | | | | | | | | | | |
| <u>5210</u> | * | * | | | | | | 0 | | | |
| TAPPAHANNOCK | | | | | | | | | | | |
| <u>5612</u> | | | | 0 | | X | X | 0 | | | |
| TOANO | | | | | | | | | | | |
| <u>5608</u> | * | * | * | | | 0 | 0 | | | | |
| TUNSTALL | | | | | | | | | | | |
| <u>5409</u> | * | * | * | * | | | | 0 | | | |
| URBANNA | | | | | | | | | | | |
| <u>5810</u> | | | | X | | X | X | X | | | |
| WALKER | | | | | | | | | | | |
| <u>5508</u> | * | * | * | | | | | | | | |
| WEST POINT | | | | | | | | | | | |
| <u>5609</u> | * | * | * | * | * | 0 | 0 | | | | |
| WILTON | | | | | | | | | | | |
| <u>5909</u> | | | | 0 | | X | X | 0 | | | |
| YORKTOWN | | | | | | | | | | | |
| <u>5806</u> | | | | X | X | | | X | | | |
| WILLIAMSBURG | | | | | | | | | | | |
| <u>5707</u> | | | | | | 0 | 0 | 0 | | | |

| QUAD NAME
& NUMBER | SHO | WAT | TMI | NWI | LRB | RVR | SHL | FPA | ECO | ERP | FLL |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| DUTCH GAP | | | | | | | | | | | |
| 5208 | | | | | | | | | 0 | | |
| CHARLES CITY | | | | | | | | | | | |
| 5407 | 0 | | | | 0 | 0 | 0 | | | | |
| NEWPORT NEWS SOUTH | | | | | | | | | | | |
| 5904 | | | | | 0 | 0 | 0 | | | | |
| HAMPTON | | | | | | | | | | | |
| 6005 | | | | | 0 | 0 | | | | | |
| ELLIOTTS CREEK | | | | | | | | 0 | | | |
| 6206 | | | | | | | | 0 | | | |
| CAPE CHARLES | | | | | | | | 0 | 0 | | |
| 6207 | | | | | | | 0 | 0 | | | |
| HOG ISLAND | | | | | | | 0 | 0 | | | |
| 5706 | | | | | | | 0 | 0 | | | |
| SURRY | | | | | | | 0 | 0 | | | |
| 5606 | | | | | | | 0 | 0 | | | |
| MULBERRY ISLAND | | | | | | | 0 | 0 | | | |
| 5805 | | | | | | | 0 | 0 | | | |
| NORFOLK NORTH | | | | | | | 0 | 0 | | | |
| 6004 | | | | | | | 0 | 0 | | | |
| LITTLE CREEK | | | | | | | 0 | 0 | | | |
| 6104 | | | | | | | 0 | 0 | | | |
| FISHERMANS ISLAND | | | | | | | 0 | 0 | | | |
| 6305 | | | | | | | 0 | 0 | | | |
| TOWNSEND | | | | | | | 0 | 0 | | | |
| 6306 | | | | | | | 0 | 0 | | | |
| FRANKTOWN | | | | | | | 0 | 0 | | | |
| 6308 | | | | | | | 0 | 0 | | | |
| JAMESVILLE | | | | | | | 0 | 0 | | | |
| 6309 | | | | | | | 0 | 0 | | | |
| NANDUA CREEK | | | | | | | 0 | 0 | | | |
| 6310 | | | | | | | 0 | 0 | | | |
| GREAT FOX ISLAND | | | | | | | 0 | 0 | | | |
| 6312 | | | | | | | 0 | 0 | | | |
| CHESCONESSEX | | | | | | | 0 | 0 | | | |
| 6411 | | | | | | | 0 | 0 | | | |
| PUNGOTEAGUE | | | | | | | 0 | 0 | | | |
| 6410 | | | | | | | 0 | 0 | | | |
| PARKSLEY | | | | | | | 0 | 0 | | | |
| 6511 | | | | | | | 0 | 0 | | | |
| SAXIS | | | | | | | 0 | 0 | | | |
| 6512 | | | | | | | 0 | 0 | | | |
| NEW POINT COMFORT | | | | | | | | 0 | | | |
| 6007 | | | | | | | | 0 | | | |
| MATHEWS | | | | | | | | | 0 | | |
| 6008 | | | | | | | | | 0 | | |

| QUAD NAME
& NUMBER | SHO | WAT | TMI | NWI | LRB | RVR | SHL | FPA | ECO | ERP | FLL |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| HOPEWELL | | | | | | | | | | | |
| <u>5207</u> | | | | | | | 0 | 0 | 0 | | |
| WESTOVER | | | | | | | | | | | |
| <u>5307</u> | | | | | 0 | | 0 | 0 | 0 | | |
| CLAREMONT | | | | | | | | | | | |
| <u>5506</u> | | | | | 0 | | 0 | 0 | 0 | | |
| BRANDON | | | | | | | | | | | |
| <u>5507</u> | | | | | 0 | | 0 | 0 | 0 | | |
| MOUNT LANDING | | | | | | | | | | | |
| <u>5512</u> | | | | | 0 | | 0 | 0 | 0 | | |
| NORGE | | | | | | | | | | | |
| <u>5607</u> | | | | | 0 | | | | 0 | | |
| TRUHART | | | | | | | | | | | |
| <u>5610</u> | | | | | | | | | 0 | | |
| DUNNSVILLE | | | | | | | | | | | |
| <u>5611</u> | | | | | 0 | | 0 | 0 | 0 | | |
| MONTROSS | | | | | | | | | | | |
| <u>5613</u> | | | | | 0 | | | | 0 | | |
| CHURCH VIEW | | | | | | | | | | | |
| <u>5710</u> | | | | | | | 0 | 0 | 0 | | |
| HAYNESVILLE | | | | | | | | | | | |
| <u>5712</u> | | | | | 0 | | | | 0 | | |
| SUFFOLK | | | | | | | | | | | |
| <u>5802</u> | | | | | | | | | 0 | | |
| BENNS CHURCH | | | | | | | | | | | |
| <u>5804</u> | | | | | | | | | 0 | | |
| GLOUCESTER | | | | | | | | | | | |
| <u>5808</u> | | | | | 0 | | | | 0 | | |
| SALUDA | | | | | | | | | | | |
| <u>5809</u> | | | | | 0 | | 0 | 0 | 0 | | |
| LIVELY | | | | | | | | | | | |
| <u>5811</u> | | | | | 0 | | 0 | 0 | | | |
| LOTTSBURG | | | | | | | | | | | |
| <u>5812</u> | | | | | 0 | | | | 0 | | |
| BOWERS HILL | | | | | | | | | | | |
| <u>5903</u> | | | | | | | | | 0 | | |
| NEWPORT NEWS NORTH | | | | | | | | | | | |
| <u>5905</u> | | | | | | | 0 | 0 | 0 | | |
| WARENECK | | | | | | | | | | | |
| <u>5908</u> | | | | | | | | | 0 | | |
| LANCASTER | | | | | | | | | | | |
| <u>5911</u> | | | | | 0 | | | | 0 | | |
| BURGESS | | | | | | | | | | | |
| <u>6012</u> | | | | | 0 | | 0 | 0 | 0 | | |
| KEMPSVILLE | | | | | | | | | | | |
| <u>6103</u> | | | | | | | | | 0 | | |

LEGEND

*- INDICATES COVERAGES CREATED BETWEEN 3/88 AND 3/89
X- INDICATES COVERAGES CREATED FROM 3/89 TO 9/89
0- INDICATES COVERAGES COMPLETED FROM 9/89 TO 9/90

SHO-SHORELINE CLASSIFICATION 1:24000
WAT-WATERSHED BOUNDARIES 1:24000
TMI-TIDAL MARSH INVENTORIES 1:24000
NWI-NATIONAL WETLANDS INVENTORIES 1:24000
LRB-LEFT/RIGHT BANK FROM USGS DLG'S 1:100000
RVR-RIVER REACH COVERAGES 1:100000
SHL-SHORELINE COVERAGES 1:24000
FPA-FLOOD PRONE AREAS 1:24000
FLL-FLIGHT LINE TRAJECTORIES 1:24000
ECO-ECOLOGICALLY SENSITIVE AREAS 1:24000
ERP-ESTUARINE RESEARCH PRESERVES 1:24000

APPENDIX II.

COMPREHENSIVE COASTAL INVENTORY
HIGH RESOLUTION SHORELINE COVERAGES

| QUAD NAME
& NUMBER | MRC | NSHL | SED | STRUCTS |
|--------------------------------------|-----|------|-----|---------|
| WESTMORELAND CO SHORELINE
6002540 | X | | 0 | |
| WESTMORELAND CO SHORELINE
6002560 | X | | 0 | |
| WESTMORELAND CO SHORELINE
6152540 | X | | 0 | |
| WESTMORELAND CO SHORELINE
6152560 | X | 0 | 0 | 0 |
| WESTMORELAND CO SHORELINE
6302500 | X | | 0 | |
| WESTMORELAND CO SHORELINE
6302540 | X | | 0 | |
| WESTMORELAND CO SHORELINE
6302560 | X | 0 | 0 | 0 |
| WESTMORELAND CO SHORELINE
6302580 | X | | | |
| WESTMORELAND CO SHORELINE
6452500 | X | | 0 | |
| WESTMORELAND CO SHORELINE
6452520 | X | | 0 | |
| WESTMORELAND CO SHORELINE
6452540 | X | 0 | 0 | 0 |
| WESTMORELAND CO SHORELINE
6452560 | X | | 0 | |
| WESTMORELAND CO SHORELINE
6602460 | X | | 0 | |
| WESTMORELAND CO SHORELINE
6602480 | X | | 0 | |
| WESTMORELAND CO SHORELINE
6602500 | X | | 0 | |
| WESTMORELAND CO SHORELINE
6602520 | X | 0 | 0 | 0 |
| WESTMORELAND CO SHORELINE
6602540 | 0 | 0 | 0 | 0 |
| WESTMORELAND CO SHORELINE
752420 | 0 | | 0 | |

| QUAD NAME
& NUMBER | MRC | NSHL | SED | STRUCTS |
|---|-----|------|-----|---------|
| WESTMORELAND CO SHORELINE
<u>6752440</u> | 0 | 0 | | |
| WESTMORELAND CO SHORELINE
<u>6752460</u> | 0 | 0 | | |
| WESTMORELAND CO SHORELINE
<u>6902420</u> | 0 | 0 | | |
| WESTMORELAND CO SHORELINE
<u>6902440</u> | 0 | 0 | | |
| WESTMORELAND CO SHORELINE
<u>7052400</u> | 0 | 0 | | |
| WESTMORELAND CO SHORELINE
<u>7052420</u> | 0 | 0 | | |
| WESTMORELAND CO SHORELINE
<u>7052440</u> | 0 | 0 | | |
| WESTMORELAND CO SHORELINE
<u>7202400</u> | 0 | 0 | | |
| WESTMORELAND CO SHORELINE
<u>7202420</u> | 0 | 0 | | |
| WESTMORELAND CO SHORELINE
<u>7352400</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5252520</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5402500</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5402520</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5402540</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5552460</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5552480</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5552500</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5552520</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5702460</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5702480</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5852460</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>5852480</u> | 0 | 0 | | |
| RICHMOND CO SHORELINE
<u>6002460</u> | 0 | 0 | | |

| QUAD NAME
& NUMBER | MRC | NSHL | SED | STRUCTS |
|-----------------------------|-----|------|-----|---------|
| RICHMOND CO SHORELINE | | | | |
| 6002480 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4652600 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4652620 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4652640 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4802560 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4802580 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4802600 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4802620 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4802640 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4952560 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4952580 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4952600 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 4952620 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 5102540 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 5102560 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 5102580 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 5102600 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 5252520 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 5252540 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 5252580 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 5402520 | 0 | 0 | | |
| LANCASTER CO SHORELINE | | | | |
| 5402540 | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE | | | | |
| 4952600 | 0 | 0 | | |

| QUAD NAME
& NUMBER | MRC | NSHL | SED | STRUCTS |
|---|-----|------|-----|---------|
| NORTHUMBERLAND CO SHORELINE
<u>4952620</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5102620</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5252600</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5252620</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5252640</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5402600</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5402620</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5402640</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5552580</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5552600</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5552620</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5552640</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5702580</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5702600</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5702620</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5702640</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5852560</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5852580</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5852600</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>5852620</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>6002540</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>6002560</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>6002580</u> | 0 | 0 | | |

| QUAD NAME
& NUMBER | MRC | NSHL | SED | STRUCTS |
|---|-----|------|-----|---------|
| NORTHUMBERLAND CO SHORELINE
<u>6002600</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>6152540</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>6152560</u> | 0 | 0 | | |
| NORTHUMBERLAND CO SHORELINE
<u>6152580</u> | 0 | 0 | | |

LEGEND

*- INDICATES COVERAGES CREATED BETWEEN 3/88 AND 3/89
 X- INDICATES COVERAGES CREATED FROM 3/89 TO 9/89
 O- INDICATES COVERAGES COMPLETED FROM 9/89 TO 9/90

MRC-MARINE RESOURCES COMMISSION SHORELINE 1:5000
 NSHL-1989 SHORELINE FROM AERIAL PHOTOGRAPHY 1:7200
 SED-SEDIMENT INVENTORY STATIONS 1:24000
 STRUCTS-SHORELINE STABILIZATION STRUCTURES 1:7200